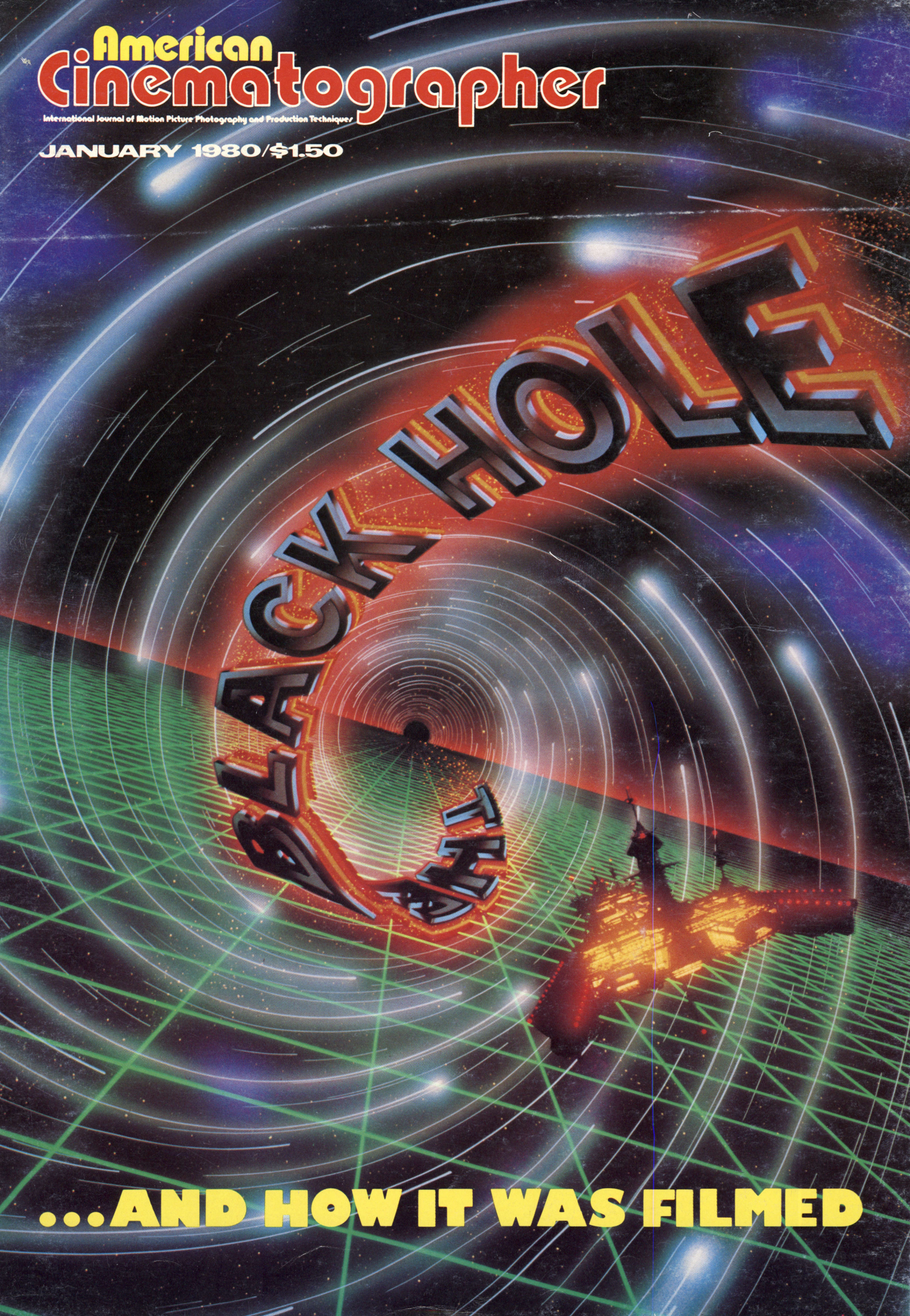
American Cinematographer
International Journal of Motion Picture Photography and Production Techniques
JANUARY 1980/$1.50



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"How Green Was My Valley" is available for syndication in the U.S. and Canada from 20th Century-Fox Television.

Here's part of the "Great Dailies" team: lower left-right: Mike Crane, Bob Hagans and Jim Schurmann; upper left-right: Phil Balcom, John Shafer and Dash Morrison.

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American Cinematographer

International Journal of Motion Picture Photography and Production Techniques

The American Society of Cinematographers is not a labor union or a guild, but is an educational, cultural and professional organization. Membership is by invitation to those who are actively engaged as Directors of Photography and have demonstrated outstanding ability. Not all cinematographers can place the initials A.S.C. after their names. A.S.C. membership has become one of the highest honors that can be bestowed upon a professional cinematographer, a mark of prestige and distinction.

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ON THE COVER: A poster representative of the Walt Disney production, THE BLACK HOLE. Design and art direction: Rod Dyer—Andy Engel. Production: Mitchell Brisker—Bob Abel and Associates. © MCMLXXIX Walt Disney Productions.

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Ed DiGiulio, President
Cinema Products Corporation

As our friends in the motion picture industry well know, concurrent with our development program for Steadicam — Cinema Products' Oscar-winning camera stabilizing system currently revolutionizing film and video production techniques all over the world — our design engineers took up another challenge, in many ways no less ambitious: GSMO.

Our aim was to provide the industry with a high-quality, sophisticated 16mm double system sound camera that would combine the basic design innovation pioneered by Eclair, namely, the quick-change cassette-type coaxial magazine, with Cinema Products' own innovative design contributions: the latest in crystal-controlled drive circuitry, on-board lightweight plug-in battery, studio-silent operation coupled with rugged modular construction that reduces downtime to a minimum, etc., etc.

And, of course, one of our major goals was to bring the GSMO in at roughly half the cost of sophisticated European imports such as the Arri 16SR and the Eclair ACL.

There are no shortcuts to design excellence. And living up to our own stringent standards was not easy.

GSMO took four years of painstaking research and development.

Plus a full year of extensive testing.

Our CP engineering staff carefully evaluated all inputs from the field, and made the required design changes.

The final result is that all of our design goals for GSMO have been successfully achieved. Some, beyond our original expectations!

Some fifty GSMO cameras — the initial production run — have already been used all over the world on actual filming assignments under the most rigorous field conditions.

I believe that GSMO is now the ideal state-of-the-art cassette-load production camera for all phases of 16mm cinematography, with a full range of sophisticated options and accessories for utmost versatility.

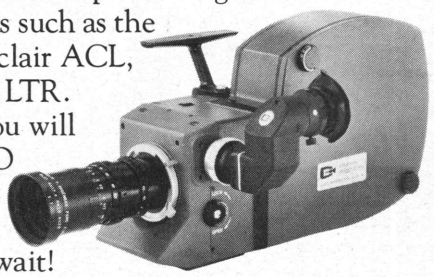
And GSMO is, unquestionably, the most *affordable* camera of its class available on the market today. Fully supported by Cinema Products' acclaimed after-sales factory backup, and a worldwide network of dealer service stations.

GSMO rental and demonstration cameras are now available for your evaluation at Cinema Products dealer showrooms all over the world. And customer back orders are being filled as rapidly as possible.

I urge you to visit your local CP dealer soon and check out the GSMO for yourself.

Test its outstanding performance.

Compare it — feature for feature, option for option, and price for price — against eminent European cameras such as the Arri 16SR, the Eclair ACL, and the Aaton 7 LTR.



I am sure you will agree that GSMO was well worth our effort. And well worth your wait!

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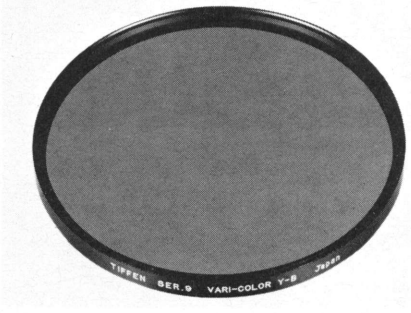

TIFFEN ADDS NEW SIZES IN VARI-COLOR FILTERS

By extending its range of Vari-Color filters recently to include Series 9, 4½, and 138mm sizes, the Tiffen Mfg. Corp. has made this versatile filter available to fit additional lens sizes.

When used in conjunction with a standard rotating polarizer, the Vari-Color filter produces infinitely variable shades of blended colors, such as red to blue, yellow to blue, red to yellow, and red to green.

The uses to which Vari-Color filters can be put run the gamut from subduing distracting reflections to creating colorful sunsets and sunrises.

Color-matching, color-correcting and color—simply for its own sake—are additional examples of the virtually limitless number of imaginative effects possible quickly and easily with Tiffen Vari-Color filters.

For more information, write to: Professional Products Division, Tiffen Mfg. Corp., 90 Oser Avenue, Hauppauge, L.I., N.Y. 11787 or see your Tiffen Dealer.

•

NEW MINI ANIMATION CAMERA STAND BY FAX

A new Mini Fax Animation Camera Stand, augmentating the popular Senior and Junior units, has been introduced by the Fax Company, 374 South Fair Oaks Ave., Pasadena, Calif. 91105, oldest exclusive manufacturer of animation stands in the United States. Whereas the original stands have been developed for more complete animation, using heavier 35mm and 16mm cameras and stop-motion drives, the new Mini Fax Stand is ideal for all animation work with either 16mm or Super-8mm cameras, and for 35mm filmstrip photography.

A black plastic plate with both top and bottom pegs is mounted on a welded steel base; it is adjustable for positioning directly under the camera. A sturdy bracket secures the camera facing the operator to position the cels or artwork top-side up. Vertical positioning of the camera is accomplished easily, and a knob clamps the bracket securely. A field chart is included. All steel and aluminum parts are finished in dull black. Leveling legs are supplied for table-mounting. Basic stand is priced at $695.

Accessories available include a 12-field disc and platen with mounting bolts for under-camera adjustment. The disc has an Opalite white window for rear projection or back lighting and is easily removed for animation production. Two bolts release the platen assembly. A leg assembly with cross-braces can be attached to the leveling leg studs. A wall-to-stand bracket also is available for rigidity. Studio quartz lamps and bulbs are available.

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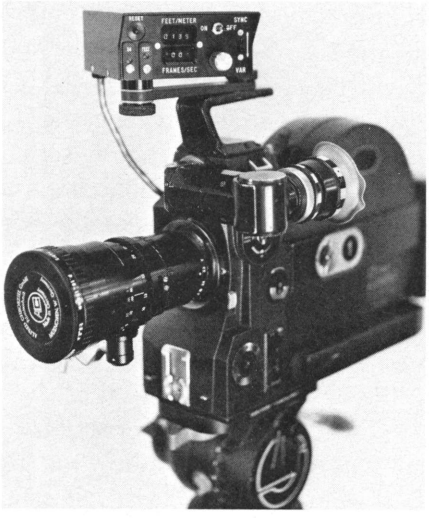

DIGITAL READOUT UNIT AVAILABLE

Jurgen's Camera Service and Cinetronics announces the introduction of DIGI-TACH for the Arri 16SR, replacing the optional Arri 16SR variable speed unit. The NEW DIGI-TACH provides variable speed control from 6 to 72 fps as well as crystal 24/25 fps.

The DIGI-TACH has a *digital readout unit* that provides: Variable speed indicator; Footage/meter counter; Tachometer.

All of this within one small unit which attaches to the handle of the 16SR for easy viewing of the operator or assistant.

All electrical connections are made through the accessory socket as the DIGI-TACH uses only 150 mA.

Originally designed for the Arri 16SR, the unit can also be used on the Arri 35BL II, 16BLEQ, and the new 16SR High Speed by the use of only a different power/module cable that plugs in easily. There is also a power/module cable that takes the roll out of filming a T.V. set.

The built-in battery automatically recharges when the unit is on providing a maximum of 1000 hours at full charge or 100 hours for each hour charged.

$995.00 fob Hollywood.

Accessories: Power/module cables for use on 35BL II, 16BLEQ, 16SR High Speed, T.V. Sync. Available separately.

DIGI-TACH is warranted for 6 months and is available from: Cinetronics, 11207 Petit Ave., Granada Hills, Ca. 91344 Jurgen's Camera Service, 7531 Sunset Blvd., Hollywood, Ca. 90046 (213) 851-5926, 874-0811.

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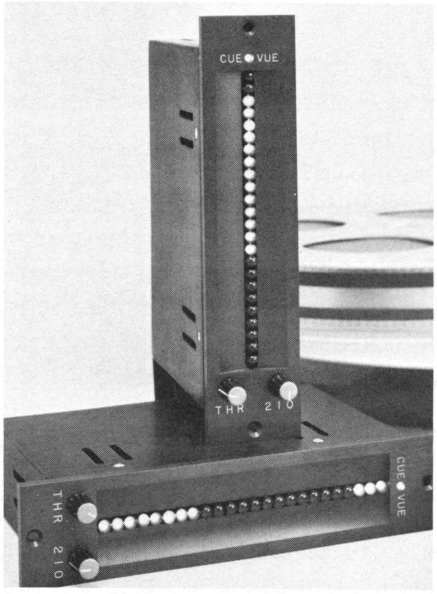


RON ALEXANDER INTRODUCES CUE VUE MODEL CV 150

CUE VUE® is designed to simplify sound rerecording and enhance the sound mix by providing direct and precise visual indications of the approach, beginnings and ends of blocks of sound on individual sound tracks.

This cueing device takes the signal from an advance playback head, determines its length and shows each block of sound approaching the regular playback head as a set of travelling lights on a column of light-emitting diodes.

With its easy to read cues, precise to 1/12th of a second, complicated tracks can be mixed with ease. When used for looping, it frees the talent to concentrate on interpretation and performance. No special preparation of the sound tracks is required.

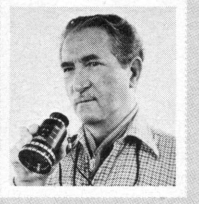
Designed for mounting at the console

Continued on Page 51

introducing the Mark IV

director's viewfinder

with 10:1 zoom



The all-new Mark IV 10:1 Zoom Director's Viewfinder is an indispensable tool for the director or cameraman in composing scenes and choosing the appropriate lenses. It is the first and only viewfinder to offer a zoom ratio of 10:1 for both 35mm and 16mm film formats, making it compatible with most standard professional zoom lenses. It is a practical, easy-to-read viewfinder that was designed after many years of research to meet the specific needs of the film director and cameraman working in the 16mm and 35mm motion picture and television fields.

Among the exclusive features of the new Mark IV 10:1 Zoom Director's Viewfinder are:

- Easy-viewing, direct-reading scales calibrated in lens focal lengths. No numbers to compute.
- Optical-quality coated glass lenses.
- Lightweight, sturdy, precise construction. Weighs only 13 ounces.
- Focusing eyepiece with collapsible rubber eye cup.
- Smooth zoom movement patterned after camera zoom lenses.
- Click-stop aspect ratio controls for selecting formats of 1.33, TV Safe Action Area, 1.66, 1.85 and 2.35.
- Three windows on barrel of viewfinder for easy readouts of focal length of specific lens for 16mm and 35mm Academy or 35mm Anamorphic format.
- Image viewed is 50% larger and gives brighter and higher quality image than any other director's viewfinder now available.

U.S. and Foreign Patents Pending

Order your Mark IV Zoom Director's Viewfinder today.

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$395.00

(Includes case and neck strap)

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Void where prohibited by law.

Offer expires 6/30/80.

When it comes to creating delicate instrumentation, Swiss perfection is legend. No less so with the impeccably engineered BOLEX H-16 EBM. The product of 50 years of Bolex experience, it achieves a new standard of accuracy for 16mm cameras with a realistic price.

To fully appreciate this accomplishment, consider the imperatives of professional filmmaking. And how superbly the EBM serves them.

The First Imperative: Effortless Handling. The photo shows a fully equipped yet perfectly handheld camera—from its one-amp battery in the pistol grip to its unbelievable 16-100mm f/1.9 Vario Switar automatic power zoom lens with built-in light meter. Total weight of this rugged, ready-to-roam package? An incredible 12½ lbs.

The Second Imperative: Uncompromising Performance. All the essentials for professional results are gathered here: chronometer accurate electric film drive, suitable for synchronized sound with your choice of crystal or sync pulse generator. A diaphragm presetting device that lets you focus and frame with full light coming into the flickerless reflex viewfinder. And all the other niceties that help you refine your technique and your results, including: variable speeds from 10 to 50 fps, built-in filter slot, automatic threading and full rewind.

The Third Imperative: Adaptability. With its positive-locking large bayonet mount and optional C-mount adapter, you can attach virtually any lens to your Bolex EBM. And for stability under all shooting conditions, choose among our versatile tripod, precision-machined monopod, or shoulder brace.

There are two power supplies available for the Bolex EBM—as much power as you'll ever need for continuous studio or on-location shooting. And with the easy clip-on 400 ft. magazine, your film capacity is sure to measure up to all your shooting requirements.

The Final Imperative: Affordability. When we say that you can rig up a quite complete system for less than half the price of other high quality 16mm cameras, you may be astonished. So initially were the many pros who have since discovered that they needn't spend a fortune to own a system which can help them build one.

We urge you to inspect the Bolex EBM carefully before you purchase any other camera. And set the perfection of Swiss movement into motion for you. **Bolex...First in sixteen.**

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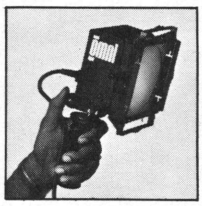
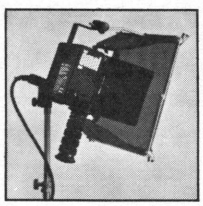
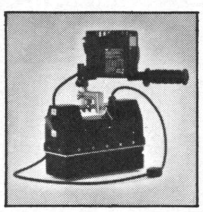
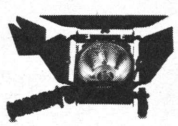
Lowel Location Lighting Systems have been selected for use at the XIII Winter Olympic Games, Lake Placid, New York.









Lowel Omni-light is a remarkably small, 650 watt focusing light. Its versatility and performance are sensational. You can convert Omni in seconds, without tools as your needs change or the job requires. From a hard light to a soft light. From news coverage to feature production. From fast moving documentary to table top shooting. From battery power to wall outlet. From 120 volts to 220/240 volts. From hand operation to stand operation. From door top mounting to wall mounting. From a focusing light to a high-intensity instrument. It's hard to believe Omni is just one light.

The secret is Omni-light's component system. You already own part of it if you own Tota-lights. But even without accessories, the Omni-light is a truly remarkable unit. The range of focus depends on the lamp and reflector used. Its minimum ratio exceeds 6:1. And Omni's maximum is an unprecedented 11:1. Full spot intensities are exceptionally high. Beam patterns are extremely even and continuously variable, through a thumb operated focus knob. Double wall construction and generous convection cooling ensure maximum life for lamps and internal wiring. Omni-light is built for sensational performance even after years of hard use.

The small sensation is performing now at authorized Lowel dealers. For a brochure contact us. Lowel-Light Manufacturing Inc., 421 W. 54th St., N.Y., N.Y. 10019. (212) 245-6744. Cable: Lowelight, N.Y., Telex: 666597 UW. West Coast: 3407 West Olive Ave., Burbank, CA 91505 (213) 846-7740 lowel™

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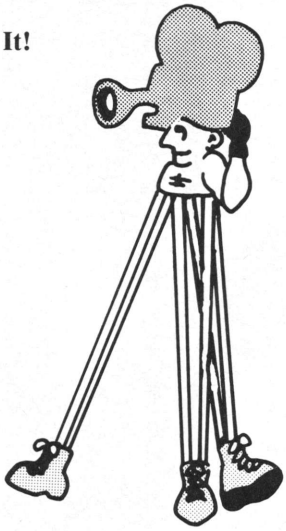
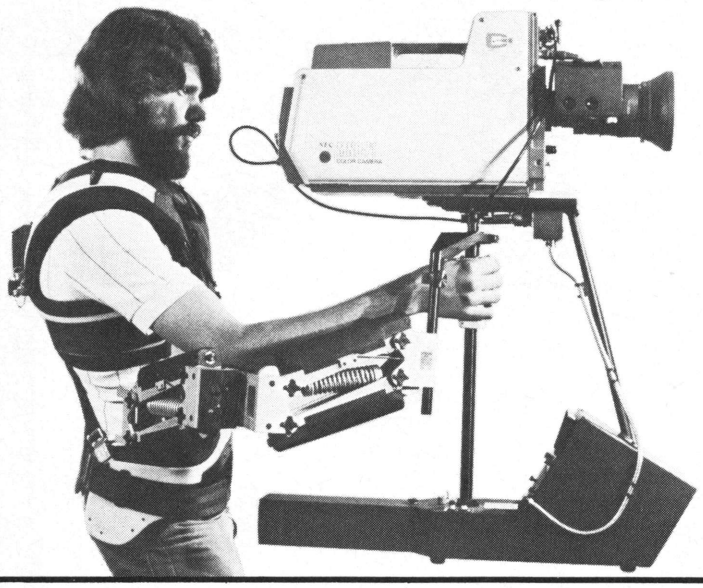
Whether you need a support item as sophisticated as a Steadicam or as simple as a shoulder pod, Brenner's has it—in stock and ready for delivery.





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THE BOOKSHELF

By GEORGE L. GEORGE

CINEMA AND CULTURE

Two basic works by eminent film historian Lewis Jacobs—indispensable to true understanding and appreciation of the significant role cinema plays in the cultural growth of our society—appear in a new edition, revised and brought up to date by the author. THE EMERGENCE OF FILM ART is a collection of texts, selected and annotated by Jacobs, that illuminate the development, between 1900 and today, of the motion picture as an artistic medium. THE DOCUMENTARY TRADITION presents the best writings on the genre by outstanding practitioners, selected, arranged and introduced by Jacobs. These two volumes have been widely adopted by colleges and other educational institutions for fundamental film courses (Norton $19.95 ea.).

Rachael Low has added two significant volumes to her authoritative and popular 4-vol. series, "History of the British Film." In FILMS OF COMMENT AND PERSUASION OF THE 1930's, she examines movies dealing with a wide variety of momentous problems of the period, and in DOCUMENTARY AND EDUCATIONAL FILMS OF THE 1930's, she describes the growing production and use of such films. Ms. Low's impeccable scholarship, her familiarity with the subject, and her perceptive approach to history give these books unique importance (Bowker $18.50 ea.).

In THE WORLD OF FILMS AND FILMMAKERS, editor Don Allen clarifies and illustrates the fusion between art, technique and personality that characterizes the filmmaking process. A large size book, superbly illustrated and explicitly written, it presents a broad image of a unique medium (Crown $19.95).

A film that has become the object of a frenetic cult and audience-participation hysterics is surveyed by Bill Henkin in THE ROCKY HORROR PICTURE SHOW BOOK. Conceived as a sci-fi thriller, this weird, sexy concoction caught the fancy of millions and played all over the world in regular and special midnight screenings. Henkin assembles a wealth of data on its production, performers, music and lyrics, and exploitation in this effectively illustrated volume (Dutton $8.95).

In THE AMERICAN NIGHTMARE, Robin Wood and others comment on the recognition by viewers and critics of the increasing convergence in horror films of the social (Marx) and sexual (Freud) revolution, and the repressive tendencies that movie monsters foist on our society (Canadian Film Institute $5.50).

The connection between film and literature is examined in three scholarly and stimulating books. In STORYTELLING AND MYTHMAKING, Frank McConnell shows how themes in famous literary works are present in essence in popular and classic films (Oxford U. Press $13.95). In FILM AND LITERATURE, Morris Beja focuses on the pairing of both modes of expression to bring out their common or disparate values (Longman $8.95). In CINELITERACY, Charles Eidsvik appraises the impact of film on society's cultural standards and educational needs (Horizon Press $15).

★ ★ ★

REFERENCE AND TECHNIQUE

In THE MOVIE MAKER'S HANDBOOK, editor Christopher Wordsworth has assembled a comprehensive guide for independent, non-professional, and home-movie makers. It provides detailed step-by-step instructions on the processes, techniques, and equipment involved. Expertly written, abundantly illustrated, this is a useful and practical manual (Ziff-Davis $25).

Independent producers, chasing glory and profits (mostly profits), will find in Sheldon Tromberg's MAKING MONEY MAKING MOVIES knowledgeable and experienced advice on producing and distributing films. It features a detailed budget for a $750,000 movie, realistic, well organized and ingenious (Franklin Watts $6.95).

The first yearly edition of TV: THE TELEVISION ANNUAL 1978-79, conceived and edited by Steven H. Scheuer, is an achievement that augurs well for future annuals. It is a thoroughgoing reference work that TV addicts as well as industryites will find indispensable for its total coverage of programming, technology, business, public interest and other relevant aspects of the medium (Macmillan $19.95/9.95).

Edited by Nicholas Van Daalen, THE COMPLETE BOOK OF MOVIE LISTS compiles, in the publisher's blurb, "1001 amazing facts, quotations, answers, opinions and statistics about movie stars, motion pictures and the people who made them." True enough, and most entertaining (Dutton $14.95/5.95).

Designing clothes for such stars as Carol Burnett, Liza Minelli, Cher is the career of Bob Mackie, who reveals in DRESSING FOR GLAMOUR (written with Gerry Bremer) secrets he's willing to share with every woman of taste and determination (A&W $14.95).

★ ★ ★

PERSONALITIES ON PARADE

Unflattering but credible, Arthur Marx's RED SKELTON portrays the performer as a paranoid, quarrelsome and altogether unpleasant individual, whose one redeaming feature was an abiding love for his leukemia-stricken son, and an exceptional gift for pantomime and slapstick comedy (Dutton $12.95).

Hector Arce's GARY COOPER devotes considerable space to the actor's love affairs—Lupe Velez, Clara Bow, Patricia Neal, Dorothy di Frasso and tutti quanti—before (and during) his lasting marriage to Rocky Balfe. In addition, Cooper's films are knowledgeably discussed (Morrow $10.95).

In TYRONE POWER: THE LAST IDOL, Fred Lawrence Guiles offers an impeccably documented and objectively written biography that examines the performer's magnetic image, successful career, unrealized dreams, lasting friendships and confused sexual drives (Doubleday $15.95).

A 21-year-old Presley, unsophisticated and sensitive, is revealed in ELVIS '56, a striking collection of stills by photojournalist Alfred Wertheimer, whose perceptive comments underline the impact of his superb lens work (Macmillan $8.95).

In THE JOHN WAYNE STORY, George Carpozzi, Jr. presents the by-now standard biography of the actor, whose life endeavored to duplicate his film image during his lengthy screen career (Arlington $10.95).

Frank Brady's BARBRA is an engaging, illustrated biography of La Streisand, whose professional and private life offered similar characteristics of single-mindedness, self-confidence and awareness of a unique talent (Grosset & Dunlap $7.95).

An inspiring document of man's triumph against odds, Bert Kopper's autobiography, WITH TWO WHEELS AND A CAMERA, tells of his successful struggle to establish himself as a professional photographer despite his polio-related handicap (Exposition $12.50). ■

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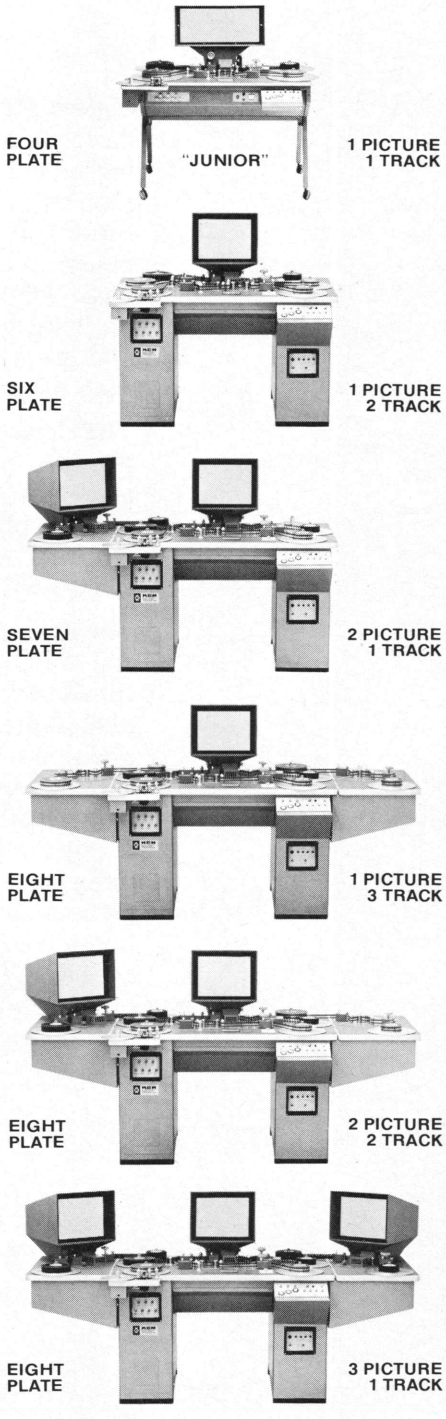

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United States Patent 3,806.016. Summary of the invention. According to the present invention, there is provided a drive mechanism which in a novel manner allows independent motion of the two elementary movements of the claw operation, in effect, of the longitudinal travel and the axial penetration, while constantly assuring the control of these basic motions through the use of uncomplicated profiled mechanical components, which are simply manufactured, and are adapted to move about axes extending parallel to each other.

The device mechanism of the present invention renders it possible to obtain, without requiring high manufacturing or assembling costs, the operating parameters essential to cinematographic production, in effect, ***noiseless operation, low wear of the film or tape perforations, and excellent positioning of the successive photograms or frames of the film.***

The device or mechanism is further distinguished in that the rod which supports the claw is pushed in the direction of film conveyance by a lug which slides along a completely plane surface, locking with a lever having a clearance or position which is imposed by sliding contact, under the pressure of a biasing spring, against a coaxially located cam, and being further adapted to engage with the motor drive disc acting on the springloaded rod. The coaxial cam has its camming surface defined by two successive radial arcs, having a difference in radii which represents as a factor of the amplification of the motion the transmission lever, the amplitude of the axial motion of the claw. All of these movements are effected about axes extending parallel to the axis of the motor drive disc.

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Ted Churchill : Three years ago I took a chance and became the first cinematographer/owner of the Aaton 7 camera in the United States. I held it, looked through it, listened to it — and bought it. As simple as that. I was convinded that Aaton was the camera. Friends however were somewhat skeptical. Often they would spot me on the street and ask about the camera even before they said hello. My ownership has become the test case for the camera in this country.

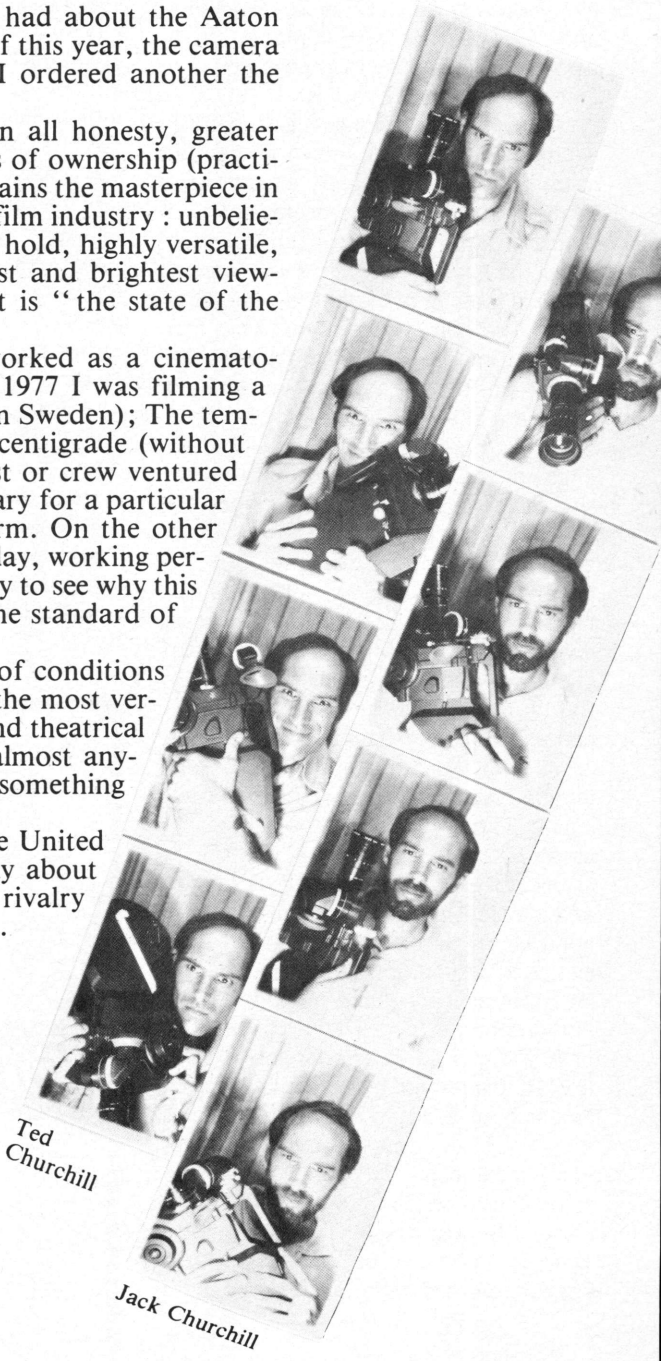
Any doubts or regrets I might have had about the Aaton were put to the test when, in March of this year, the camera was stolen on a job in New York. I ordered another the same day.

My commitment to the camera is, in all honesty, greater than ever. After two and a half years of ownership (practically trouble free) the camera still remains the masterpiece in design and engineering of the 16 mm film industry : unbelievably quiet, light and comfortable to hold, highly versatile, easily serviceable and with the largest and brightest viewfinder of any camera I have seen, it is " the state of the art ".

Jack Churchill : I have lived and worked as a cinematographer in Sweden for ten years. In 1977 I was filming a super-16 feature in Lapland (Northern Sweden); The temperature was 30 degrees below zero centigrade (without wind-chill factor). No one on the cast or crew ventured outside unless it was absolutely necessary for a particular shot. There was no way to keep warm. On the other hand the Aaton stayed out the whole day, working perfectly and with no complaints. It is easy to see why this good natured machine had become the standard of the Swedish Film industry.

It was experiences under these types of conditions that convinced me that besides being the most versatile camera for both documentary and theatrical films, the Aaton could stand up to almost anything as well. It's hard to believe that something so beautiful could be so tough.

Consequently, when I returned to the United States and heard what Ted had to say about his Aaton, it wasn't entirely sibling rivalry that prompted me to buy one as well.



Ted Churchill

Jack Churchill

CINEMA WORKSHOP

By ANTON WILSON

BACK-FOCUS

It has been emphasized that a video ENG/EFP camera should be maintained only by a qualified technician or engineer who can "tweak" the many electronic adjustments for optimum performance. However, there are several important checks and adjustments that every video cameraman can and should perform to ensure optimum operation in the field. Proper back-focus is essential to sharp pictures, especially at short focal lengths and large apertures. Back-focus on a video camera is easy to check and is, in many cases, easy to adjust.

Most cinematographers are familiar with back-focus, also known as flange-to-focal-plane distance or, simply, lens seating. Basically, the camera lens is a projector lens, focusing a bright image some distance away onto the "screen" which is the film plane or the video tube plane. The back-focus refers to the fact that the image plane must be at the proper position relative to the lens to achieve a sharp, in-focus image.

Just as there is a "depth-of-field" tolerance for the subject, there is a corresponding "depth-of-focus" tolerance for the image plane behind the lens. However, as the aperture increases and the focal length gets *shorter,* this depth-of-focus tolerance becomes extremely narrow. In reality, the back-focus tolerance of a modern wide angle, ultra fast ENG/EFP zoom lens set at 9mm and f/1.6 is non-existent. The back-focus tolerance is so small (on the order of one ten-thousandth of an inch) that the lens seating has to be "spot on" or the picture will be soft.

Of course, as the aperture gets smaller and the focal length increases, this tolerance is not as critical. An almost sure symptom of improper back-focus is the lens that delivers a sharp image at say 20mm or more, and f/8, and yet looks soft at 10mm and f/1.8. Most important, unlike the fixed focal length lens, the front focusing of a zoom lens *cannot* compensate for or rectify improper back-focus distances.

Most cine lenses do not incorporate back-focus adjustments, nor is it encouraged to "marry" a particular lens to a specific camera. The proper procedure requires the cine lens mount to be shimmed in the shop to precisely the proper flange-to-focal-plane distance by employing a collimator. Likewise, the camera flange-to-focal-plane distance is adjusted with precision micrometers and, thus, any lens will fit any camera and maintain proper back-focus.

While this concept of back-focus is identical in a video camera, the practicalities are somewhat different. The video camera employs a complex prism assembly which trisects the image path and directs it to three separate image planes: the red, green and blue pick-up tubes. This fact results in two major differences relative to a film camera. Firstly, this optical complexity makes the marrying of a zoom lens to a particular camera almost a necessity. That is, the back-focus should be adjusted with the lens *on the camera.* Secondly, because there are three image planes, there are actually three back-focus distances and thus three back-focus adjustments.

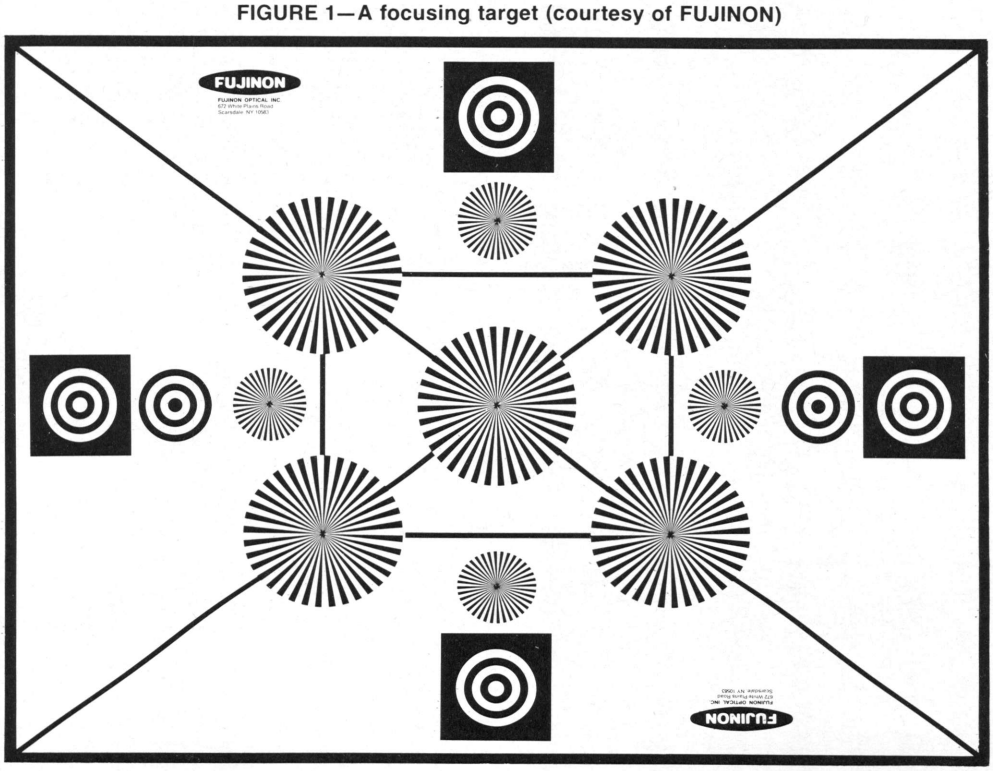
Actually there are four possible back-focus adjustments on the video camera. Each of the three tubes can be moved in or out relative to the prism assembly and the lens seating can also be adjusted relative to the camera prism. The cameraman should only concern himself with the latter. He should never attempt to adjust the individual tubes in the field.

A cameraman can check overall back-focus of the lens to the camera in the following manner. A focusing target similar to that in FIGURE I should be placed as close as possible to the lens, usually at the lens' minimum focusing distance. Most important, the lens must be wide open at maximum aperture. This can be achieved by controlling the lighting, not the iris. Normal room lighting is usually sufficient to achieve the condition. However, in darker areas a small light can be bounced off the ceiling. If a room is too bright and cannot be dimmed, use an N.D. filter if necessary. However, under all circumstances the lens must be *wide open.* Next, zoom in to the target to full telephoto. Pull a critical focus on the target, white balance, and then zoom out to the extreme minimum focal length. It is imperative that the adjustment be made at maximum aperture and minimum focal length, as this is where the back-focus tolerance is most critical.

Most ENG/EFP lenses have a back-focus adjustment ring at the rearmost part of the lens, just before the lens mount. This ring usually incorporates a locking screw, as well as an index in the form of a white dot on the ring and a corresponding dot on the lens barrel. Ac-

Continued on Page 69

FIGURE 1—A focusing target (courtesy of FUJINON)



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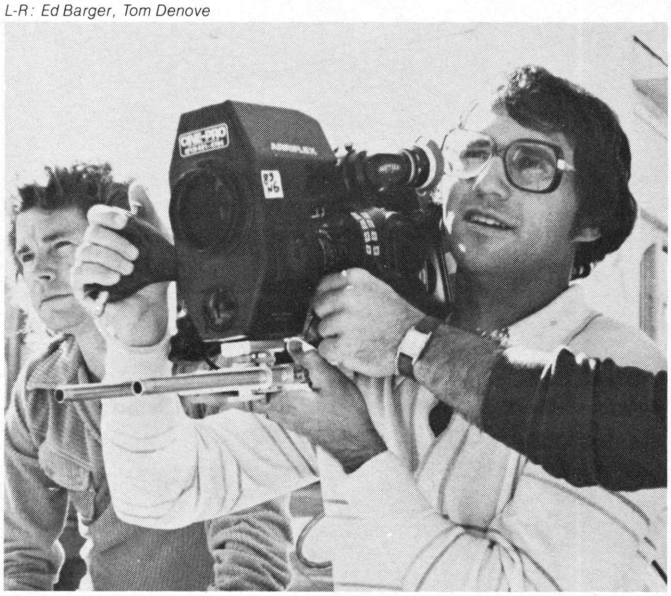

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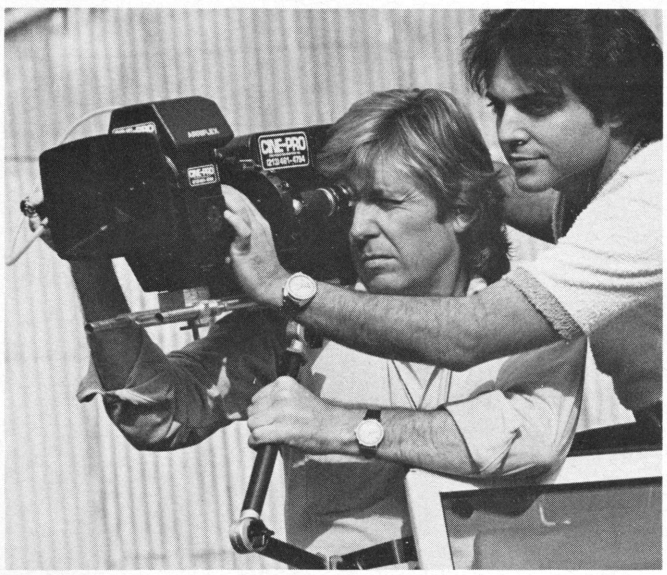

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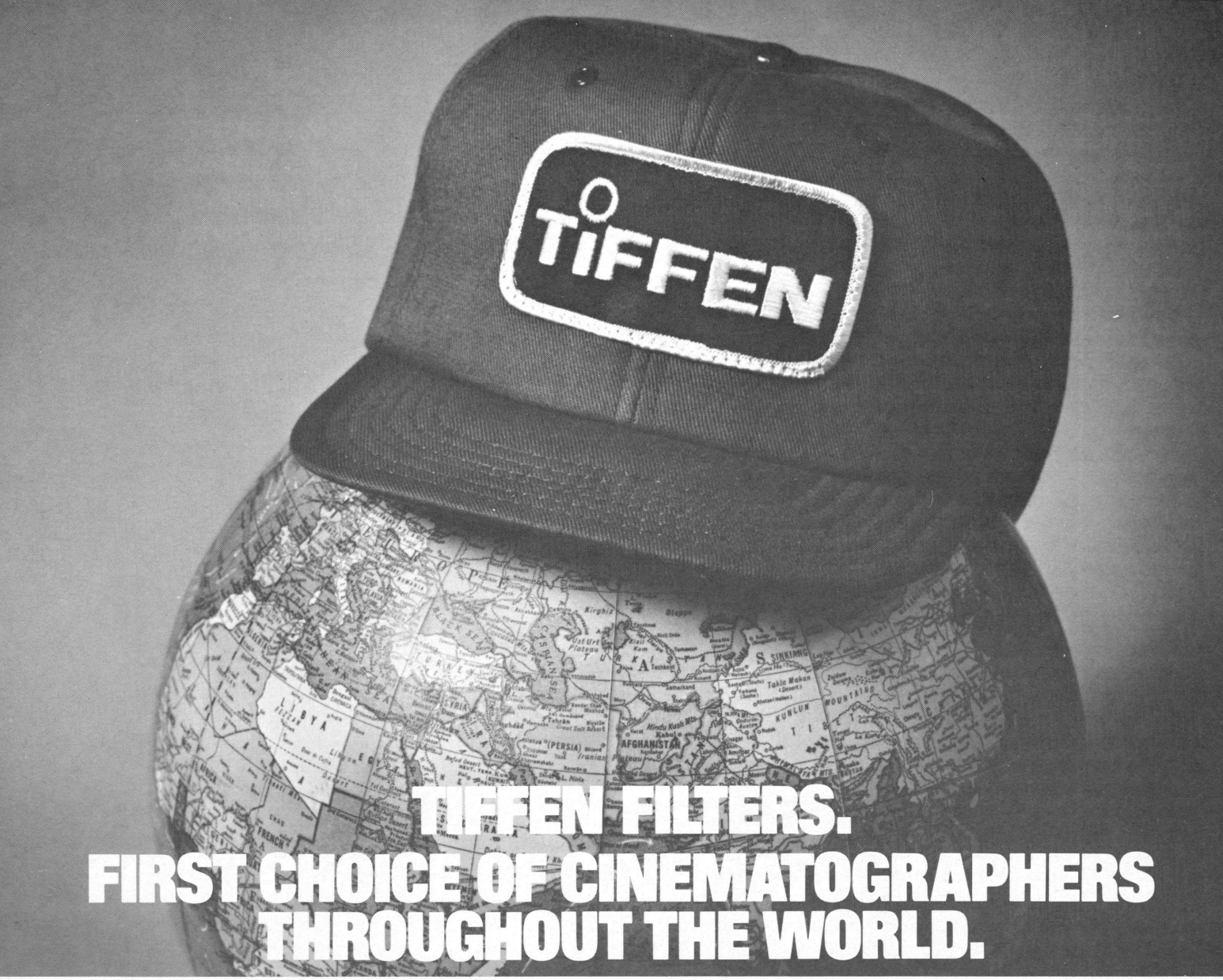

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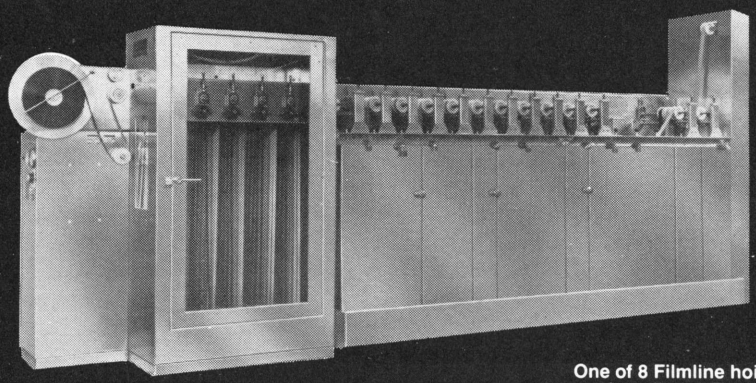

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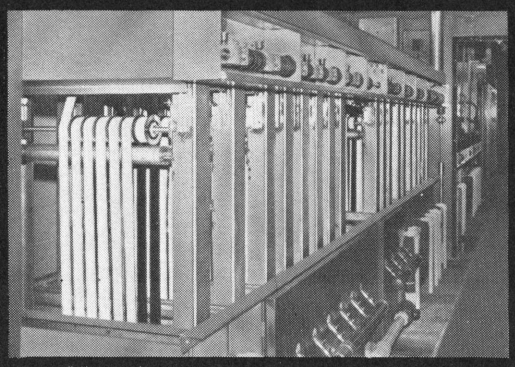

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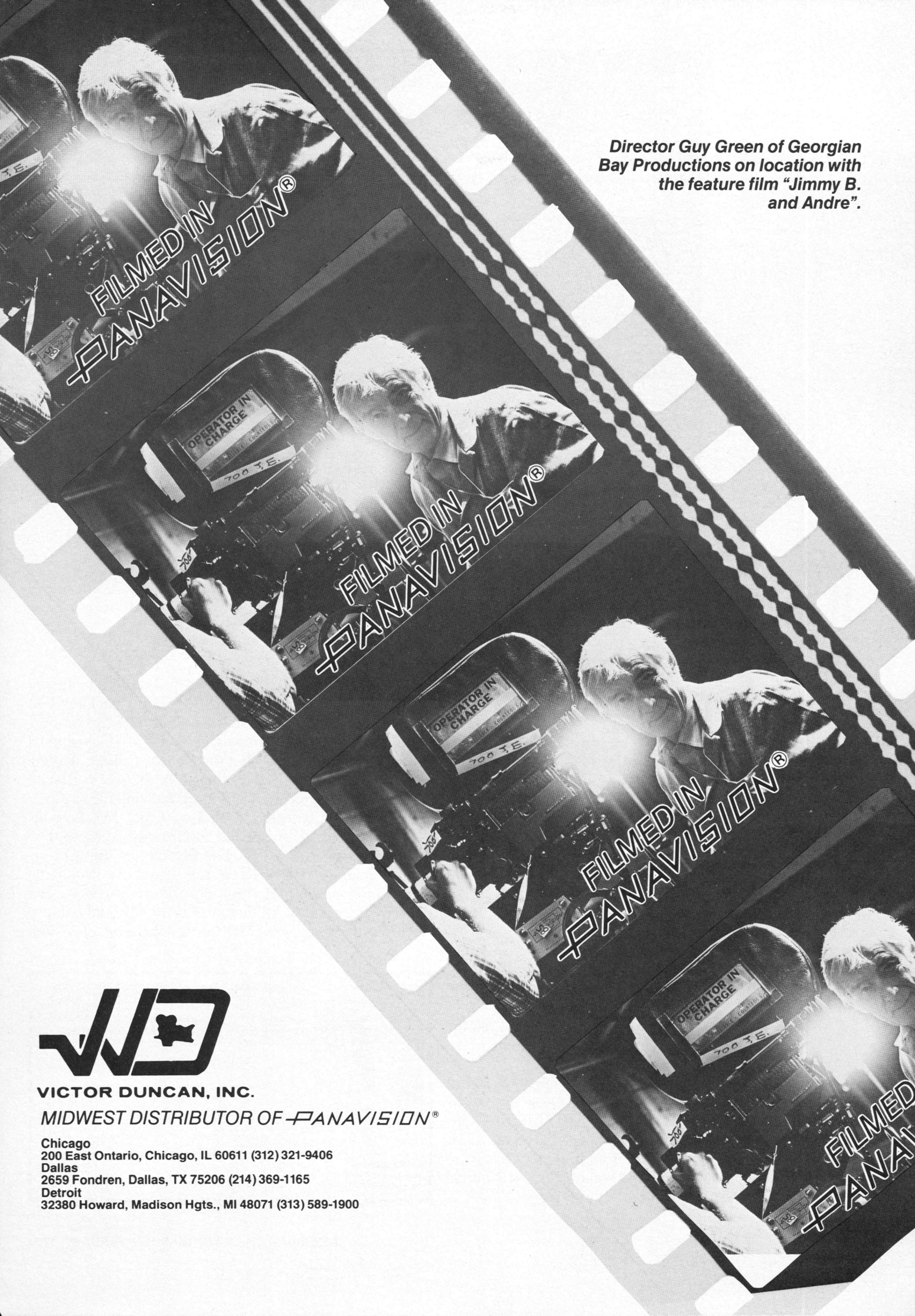

Director Guy Green of Georgian Bay Productions on location with the feature film "Jimmy B. and Andre".

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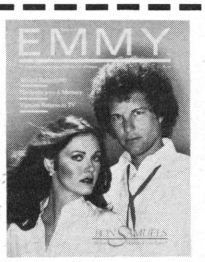

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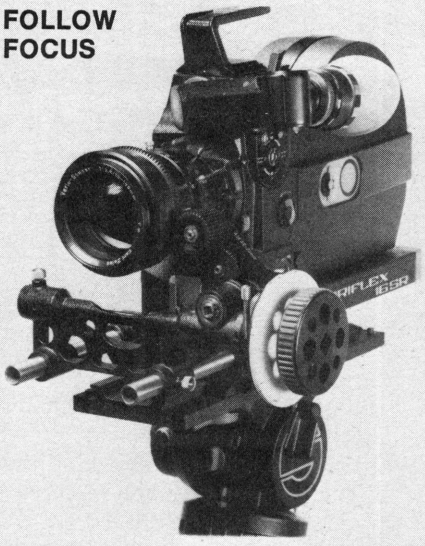

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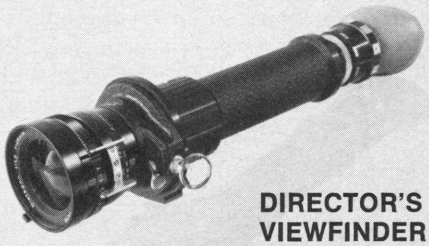

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THE HONOR ROLL

BURNETT GUFFEY, ASC

"Burnie Guffey, ASC is a cinema individualist who believes that black and white cinematography is its own art form, and that comparing black and white to color is the same as comparing a charcoal etching with an oil painting; each could be an artistic achievement." This was an introduction to Guffey when he did an article in *AMERICAN CINEMATOGRAPHER* in 1965 on a movie called KING RAT.

Guffey had already received an Academy Award for FROM HERE TO ENTERNITY and was pointing out the fallacy of the Academy in lumping together black and white and color movies in one category. He had also received two nominations for THE HARDER THEY FALL and BIRDMAN OF ALCATRAZ, also black and white movies.

Guffey went on to state, "I've done enough work in both color and black and white to convince me that it's more of a challenge to do a good job in black and white than it is in color. And I'm in total agreement with the writer who said, 'black and white photography seems better suited to a certain type of film drama, such as the mystery or melodrama'."

In 1967, when Guffey was doing BONNIE & CLYDE, for which he received an Academy Award in 1968, he said in answer to a question regarding his subduing of the color, "Color in itself sometimes detracts from realism because it comes out pretty whether you want it to or not. We tried very hard to subdue the color in this picture mostly through the handling of the sets—dirty motel walls, old bank buildings and that sort of thing."

BONNIE AND CLYDE was the opposite extreme from his previous assignment, a slick, high-key glamor film, HOW TO SUCCEED IN BUSINESS WITHOUT REALLY TRYING.

Guffey was born in Tennessee and came to California with his father, in his teens. Because of a shortage of money, he was unable to go to college but he was confident he could make it without a diploma.

One day he walked into a movie studio across the street from his uncle's house and got a job in the camera department. Guffey became the assistant cameraman on COURTSHIP OF MILES STANDISH in 1923. Shortly thereafter he went to work for William Fox at the old Fox Western Avenue studios where he served as assistant to such cinematographers as George Schneiderman, Joseph August, Reggie Lyons, and Alan Davies.

About the time panchromatic film was introduced for the first time (1926-27), Guffey moved to Famous Players-Laskey Studios (which later became Paramount) where he served as assistant to Faxon Dean. He also handled some of the still work during this period.

In 1928, he was promoted to operator under J. J. Mescal, ASC at Pathe (DeMille Studio) where he did LEATHERNECK and HIGH VOLTAGE. He later worked with Karl Struss, William Marshall, Roy Hunt, Leo Tover, Clyde DeVinna, Eddie Cronjager and Nick Musuraca at RKO and Gregg Toland.

Subsequently he became Rudy Mate's operator and when Mate went to Columbia Studios in 1943, the studio promoted Guffey to Director of Photography.

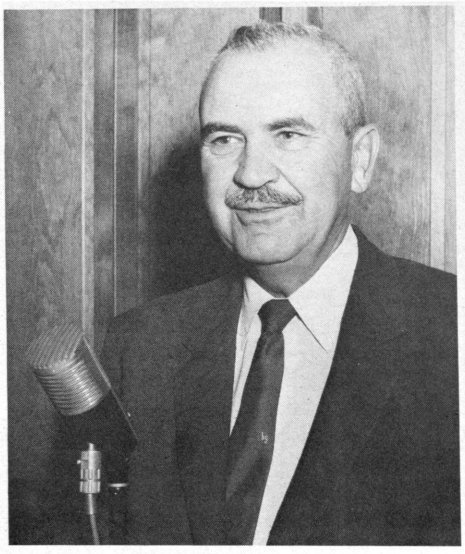
Guffey soon moved to Columbia and in one year did NIGHT EDITOR, SO DARK THE NIGHT, LONE WOLF ON BROADWAY, BOSTON BLACKIE, SONG OF BROADWAY, JULIA ROSS, GIRL OF THE LIMBERLOST, THE GAY SENORITA and THE FIGHTING GUARDSMAN.

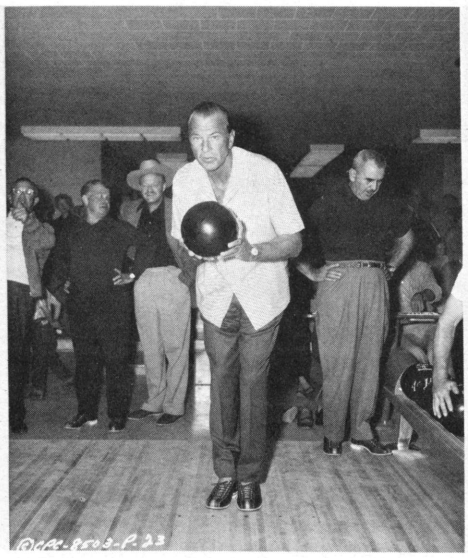
In 1946, Guffey was invited to join the American Society of Cinematographers by Ralph B. Staub and Joseph Walker. He was elected to the board of Governors in 1954 and has served more or less continuously since then. In 1957 he was elected president of the Society.

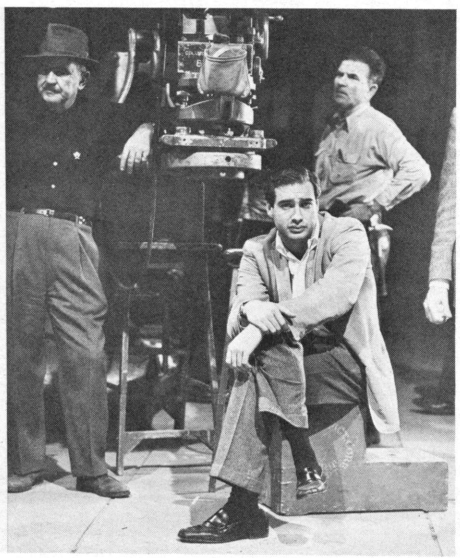
He has been first vice-president of IATSE cameramen's local (659) and has served on its board. In the board capacity he distinguished himself as a champion of the cameramen when he proposed and aided in bringing to fruition the 5-day work week for technical employees of the Hollywood motion picture studios.

In 1975 he "officially" retired in the industry and lives in the lovely community of Goleta, outside of Santa Barbara, from which he commutes monthly to attend our board meetings. ■

(LEFT) Burnett Guffey chairing an ASC meeting in 1957, (MIDDLE) Gary Cooper and Burnie Guffey relaxing after a hard day's shooting on THEY CAME TO CORDURA. (RIGHT) Burnett Guffey, ASC, and John Frankenheimer, director, waiting for a set-up on the set of BIRDMAN OF ALCATRAZ.







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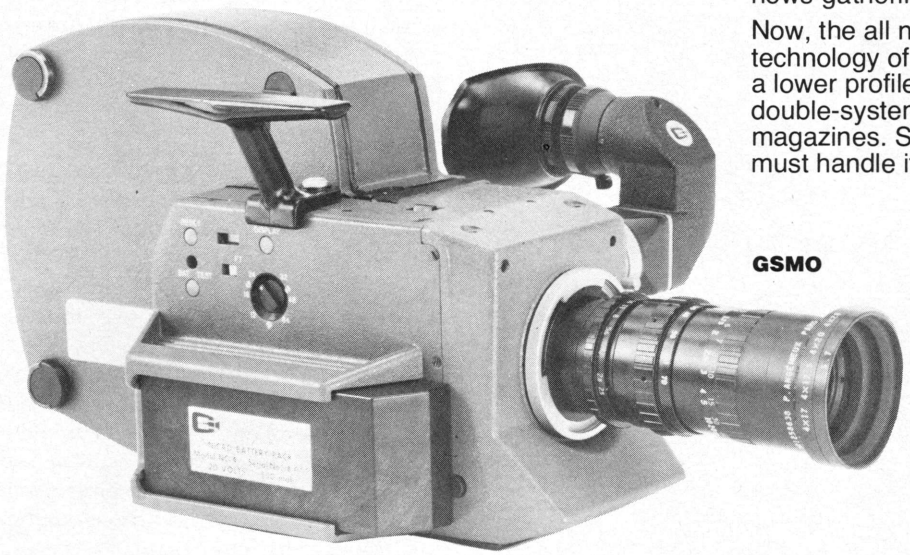

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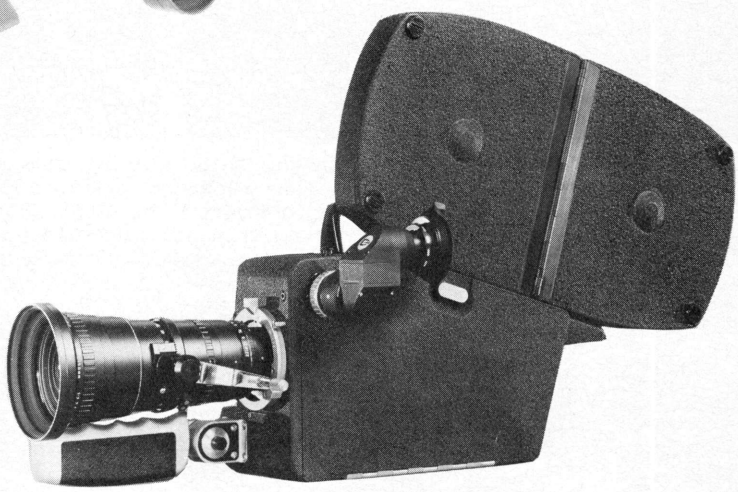

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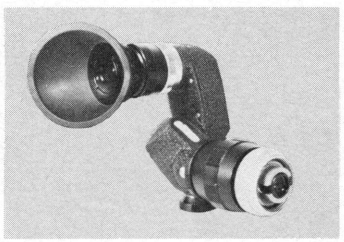

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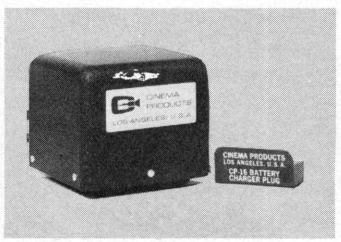

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BEHIND THE SCENES OF "THE BLACK HOLE"

To create this spectacular science-fiction adventure film, the most ambitious (and expensive) motion picture in its history, Walt Disney Productions assembled an unparalleled team of outstanding technicians

Filming a scene in a studio set representing the Command Module of a giant derelict spaceship, the U.S.S. Cygnus, missing in deep space for more than 20 years. The huge sets for THE BLACK HOLE filled the largest stages at Disney Studios wall-to-wall. (BELOW) Maximilian Schell, in the role of Dr. Hans Reinhardt, whose brilliant scientific mind is clouded with madness, confronts his namesake, Maximilian, a really bad-news robot.

THE BLACK HOLE, a $20 million deep-space adventure about science's ultimate phenomenon, is the most ambitious motion picture in the history of Walt Disney Productions.

Starring Maximilian Schell, Anthony Perkins, Robert Forster, Joseph Bottoms, Yvette Mimieux and Ernest Borgnine, the film explores an experience with a black hole, a cosmic mystery so great it forces scientists to question their belief in the lawful order of the universe.

Producer Ron Miller assembled some of the most accomplished professionals in Hollywood for the motion picture, headed by director Gary Nelson, whose latest accomplishment was being nominated for an Emmy for television's WASHINGTON: BEHIND CLOSED DOORS. Nelson began first unit production October 11, 1978 and continued for more than 120 shooting days, until mid-April. All sound stages at Disney studio were occupied by the production and were closed to visitors to insure the secrecy of story and design.

In preparation for five years, THE BLACK HOLE was delayed after the death of its original producer Winston Hibler.

Nearly 14 months of simultaneous and post-production filming and processing were required by the studio's photographic process laboratory and special effects departments for a Christmas, 1979 release. In some scenes, as many as 12 different photo processes are used simultaneously on the screen.

Four Academy Award winners supervised special effects: Peter Ellenshaw, production designer and director of special effects; Eustace Lycett and Art Cruickshank, special photographic effects, and Danny Lee, special mechanical effects.

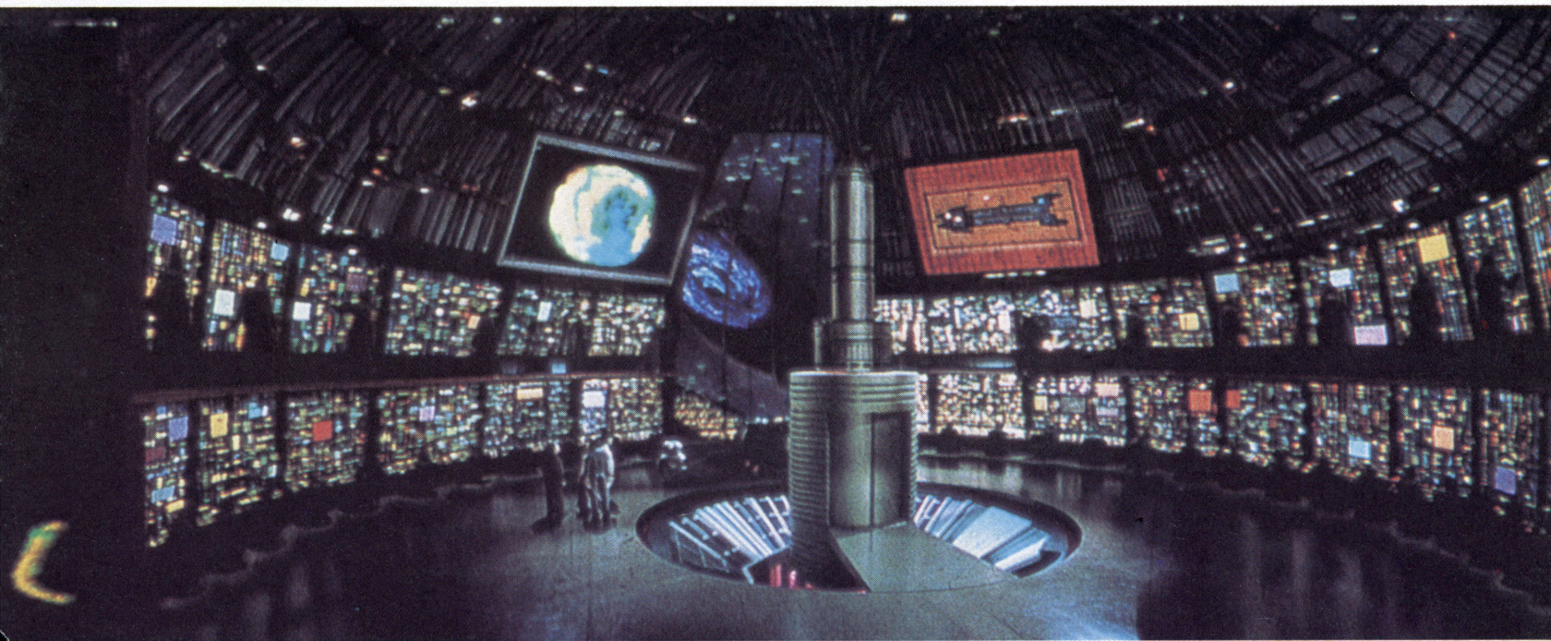
Ellenshaw, a renowned artist in his own right, won an Academy Award for his matte art on MARY POPPINS. On THE BLACK HOLE, he culled facts and figures and collated them with special design artistry.

An all-new camera system known as ACES (Automated Camera Effects System) was developed for intricate shots by Disney technicians and was run by computers housed in their own control room next to the set. Lycett won Oscars for MARY POPPINS and BEDKNOBS AND

Continued on Page 92

Very much a major (though non-human) character in THE BLACK HOLE is the giant derelict spacecraft U.S.S. Cygnus, shown in this rendering by Production Designer Peter Ellenshaw beginning to fragment, as it is drawn into the Black Hole. (BELOW) Two more non-human "characters" in the deep-space drama are (left) the explorer spaceship U.S.S. Palamino, which encounters the Cygnus, after it has been missing for more than 20 years, and (right) the awesome Black Hole itself.

The Command Module of the Cygnus is one of several huge sets built for THE BLACK HOLE at Disney Studios, which for many years has been Hollywood's leading "magic factory". Four Academy Award winners supervised the film's dazzling effects: Peter Ellenshaw (Production Designer and Supervisor of Miniature Effects), Eustace Lycett (Composite Optical Photography), Art Cruickshank, ASC (Director of Miniature Photography), and Danny Lee (Special Mechanical Effects).



DESIGNING A DEEP SPACE WORLD FOR "THE BLACK HOLE"

An old hand at creating fantasy worlds strives toward—and succeeds in—designing spaceships that don't look like all the others, plus a low-key, *"mysterioso"* Universe that is not flooded by bright light

Peter Ellenshaw's career has spanned 45 years of active motion picture work in England and the U.S., included more than 50 films for several major producers and has now culminated in his work as production designer and director of special effects for Walt Disney Productions' $20 million deep-space adventure, THE BLACK HOLE.

One should not be fooled by his slight build, British equanimity, or self-effacing sense of humor—Peter Ellenshaw is a creatively powerful personality, and his power lies in his imagination. That imagination is much in evidence in the 33 Disney films he has worked on. Ellenshaw's artistry has recently been showcased with tributes in New York's Museum of Modern Art, The Academy of Motion Pictures Arts and Sciences, the Chicago International Film Festival, and the American Film Institute in Washington, D.C.

Ellenshaw has achieved true mastery at creating fantasy worlds that exist only on celluloid. He learned his trade as assistant matte artist on such great Alexander Korda epics as THINGS TO COME (a terrifying and hopeful vision of the future), THE THIEF OF BAGDAD (a fantasy masterpiece that brought all of the Arabian nights magic to life), REMBRANDT and VICTORIA THE GREAT. After five years in the Royal Air Force during World War II, Ellenshaw worked on his own as matte artist for Michael Powell's STAIRWAY TO HEAVEN and BLACK NARCISSUS. Mervyn LeRoy asked Ellenshaw to paint the mattes for his regal epic QUO VADIS.

Walt Disney used to say jokingly that he discovered Ellenshaw making chalk drawings on the sidewalk in London's Trafalgar Square. In truth the long and close association of these two creative artists began in quite a different way. Ellenshaw had long been working as a matte artist for the top British filmmakers when, in 1948, Walt Disney went to England to begin production of his live-action features, TREASURE ISLAND, THE STORY OF ROBIN HOOD, SWORD AND THE ROSE and ROB ROY. To recreate a long-gone England, Disney chose Ellenshaw.

About the same time, Disney began planning production of Jules Verne's science fiction classic, 20,000 LEAGUES UNDER THE SEA, and he brought Ellenshaw to the Disney Studio in Hollywood. Ellenshaw followed production progress on the underwater epic and in his spare time made sketches of how he visualized Nemo's submarine Nautilus.

Walt Disney's habit was to walk through his studio after hours, examining his artists' work, what ideas they had rejected, what they doodled. It was a complete surprise to Ellenshaw one morning at a 20,000 LEAGUES production conference when Disney told the head of special effects, "Take a look at Peter's stuff. I think he has some good ideas here." Ellenshaw's conceptions of a backlit submarine were included, and he went on to supervise the matte shots and miniature work that helped win an Academy Award for Special Effects in 1954.

Soon after came DARBY O'GILL AND THE LITTLE PEOPLE (directors Steven Spielberg and John Landis have said they feel it is the finest example of perspective special effects ever made). Ellenshaw planned and designed DARBY to be shot without process photography on one gigantic set which required so much light to maintain depth of field, that the Burbank utilities lost a substation when the power was turned on without warning.

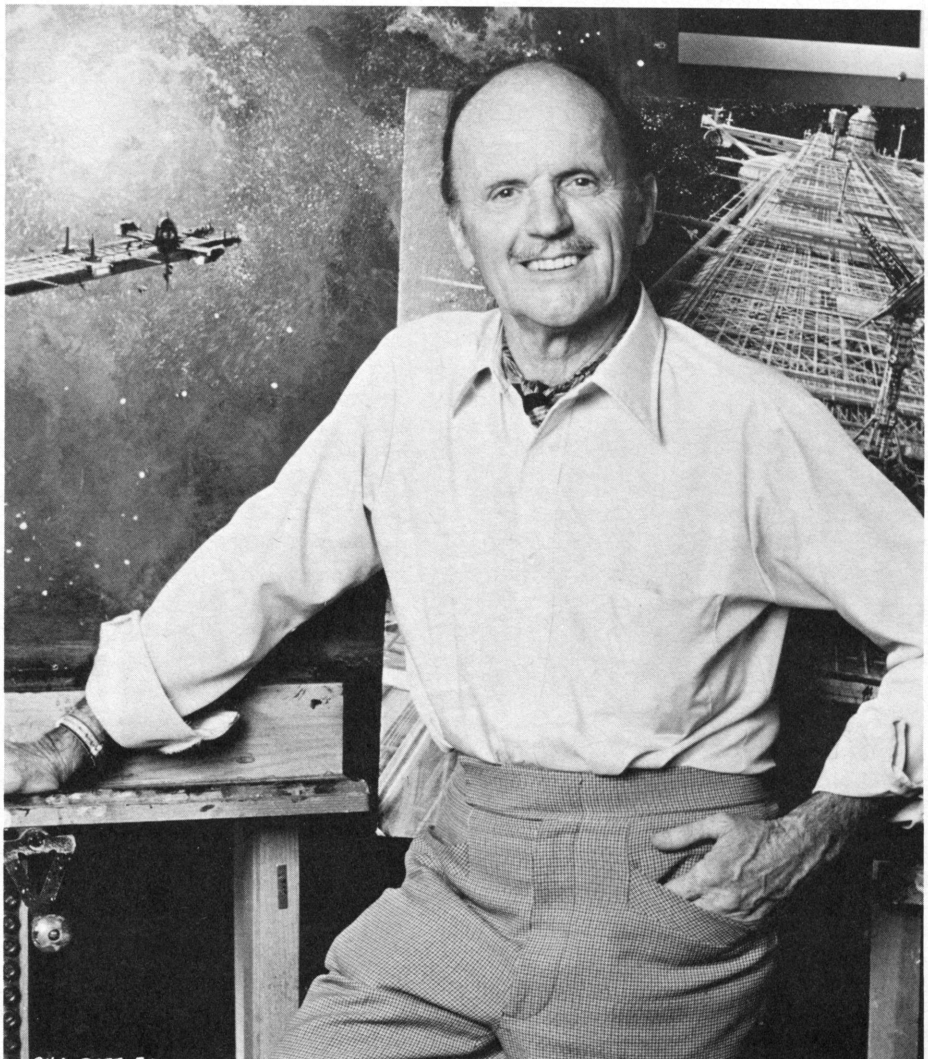
In 1964, Peter Ellenshaw received his own Oscar for work on Disney's MARY POPPINS. The film is an amazing amalgamation of animation, live-action, and optical and mechanical special effects.

In between these Disney motion pictures, he managed time in 1960 to paint mattes for Stanley Kubrick's SPARTACUS.

Ellenshaw considered retirement in 1973 and returned to his home in Santa Barbara, having finished production design for Disney's ISLAND AT THE TOP OF THE WORLD. But Disney producer Winston Hibler had an idea for an outer space movie he wanted to make and asked Ellenshaw to come back. When Hibler died in 1975, the idea was carried on by producer Ron Miller. Ellenshaw returned to Hollywood where his imagination has been a driving force behind THE BLACK HOLE.

"I was intrigued by the idea of working on a space picture," says Ellenshaw, ex-

In his dual capacity of Production Designer and Creator and Supervisor of Miniature Effects, Peter Ellenshaw brought to THE BLACK HOLE 45 years of cinematic expertise. A fine artist in his own right, Ellenshaw's work has recently been showcased at the Museum of Modern Art, The Academy of Motion Picture Arts and Sciences, the Chicago International Film Festival, and the American Film Institute in Washington, D.C.



plaining why he left the comfort of his Santa Barbara home and a lucrative profession as a landscape artist for the unnerving demands of a big-budget picture.

"I saw a chance to do something that would look really different, so I took the job. Little did I know I'd be on it for three years."

When Ellenshaw began on THE BLACK HOLE in August, 1976, his first step was to paint conceptual drawings of key scenes. These renderings focused on the Cygnus, a half-mile long spacecraft aboard which most of the action takes place. He drew observatories, agricultural centers, power troughs, and violent explosions. His single enigma was the look of the film's robots. Another artist was eventually commissioned for the job. "Every time I drew a robot," Ellenshaw laments, "it bore an uncanny resemblance to the Michelin tire trademark."

Since THE BLACK HOLE is set entirely in deep space, where five explorers discover a long-lost space station orbiting a black hole, every known mechanical and optical effect was used to tell the story. These, too, were Peter Ellenshaw's concern.

Six months were spent constructing miniature models of the spacecraft. The miniatures were photographed with the Automatic Camera Effects System (ACES), a computerized camera developed by Disney engineers. 150 matte paintings, supervised by Ellenshaw's son, Harrison (who painted the 13 matte shots in STAR WARS), are used in the film.

Then of course there was a bagful of mechanical tricks: explosions, smoke, steam, wind, actors on wires to make them appear weightless—all to help realize Ellenshaw's vision of THE BLACK HOLE.

It has been a Herculean filmmaking task. Gary Nelson directed actors Maximilian Schell, Anthony Perkins, Robert Forster, Joseph Bottoms, Yvette Mimieux and Ernest Borgnine through a 130-day live-action shooting schedule. Special effects shooting began in April, 1978, and finished 18 months later. Six months of laboratory processing were necessary to print the optical effects on film. Small wonder that Disney is calling THE BLACK HOLE its most ambitious film project ever. And neither does it come as a surprise that Peter Ellenshaw, whose mind's eye has 20/20 vision, provided its inspiration.

"I have an ambivalent attitude toward movies," says Ellenshaw after three-and-a-half years with THE BLACK HOLE. "I'm an artist who likes to paint. It happens that I've been in the film business 45 years because people found my artistic skills useful. Of course, it's always better for an artist to work alone, which is why I consider landscape painting my true profession. In a film, my skills must be balanced with those of a dozen people, and with THE BLACK HOLE I've done all there is for me to do in filmmaking. But I still have a lot to learn about landscapes."

The late Walt Disney and Peter Ellenshaw discuss JOHNNY TREMAIN (1957), on which Ellenshaw served as Production Designer. Making his mark originally as a matte painting artist, Ellenshaw moved naturally into special photographic effects and production design, encouraged by Disney, who always felt that his artists and technicians should stretch their talents.

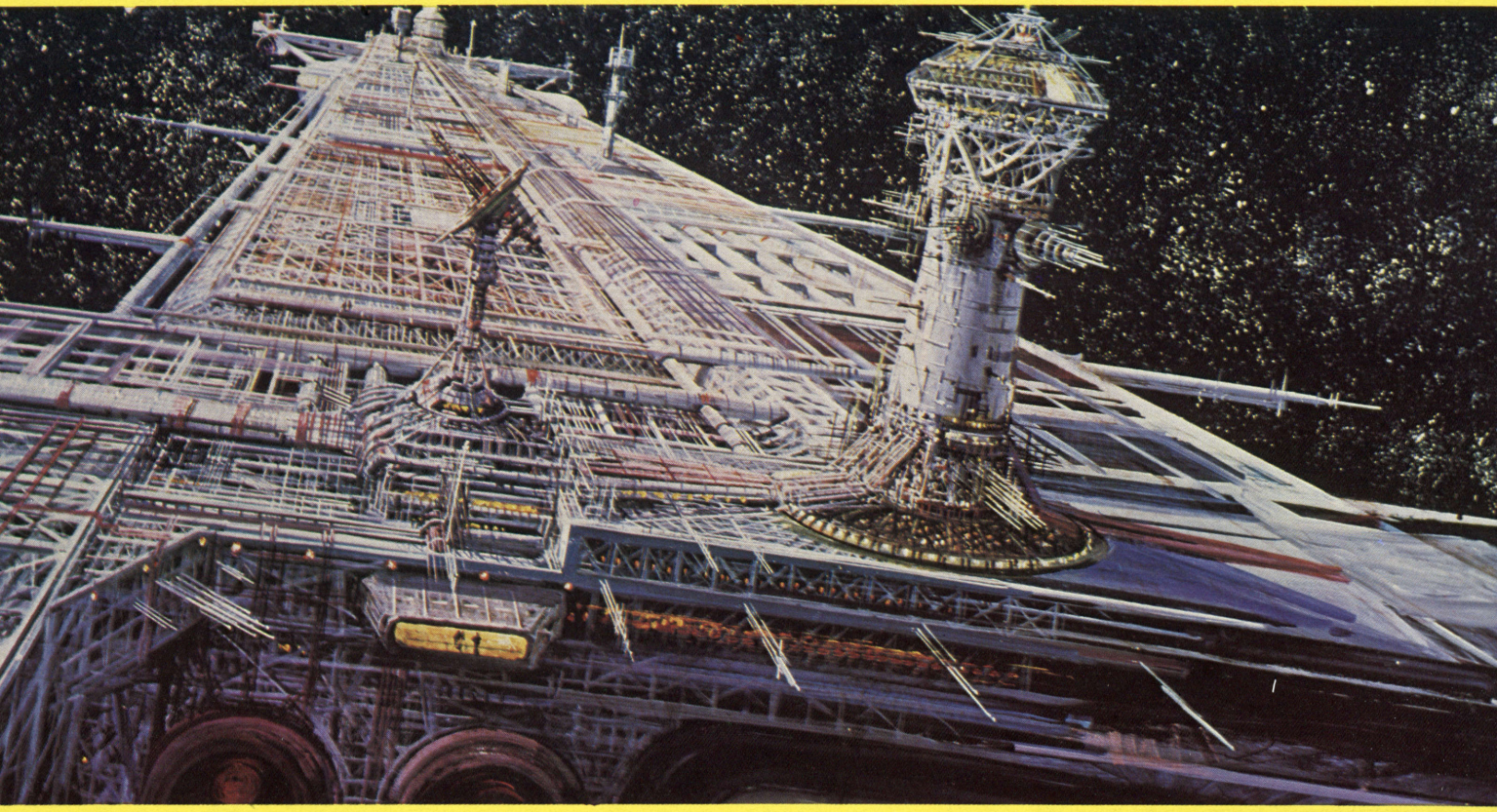
In the following interview for *American Cinematographer,* conducted at the time when THE BLACK HOLE was still in the final stages of production, Peter Ellenshaw discusses the techniques used and the challenges inherent in his dual capacity as Production Designer and Creator and Supervisor of Miniature Effects on the film.

QUESTION: At this moment, with several more weeks to go until the release of THE BLACK HOLE, can you tell me how long you've been working on the project?

ELLENSHAW: I came onto THE BLACK HOLE three years ago August, so I've been working on it for more than three years. I must emphasize from the start that, although as Production Designer and Creator and Supervisor of Miniature Effects, I am supposed to be a "key Person" on THE BLACK HOLE, we are very much a closely linked team at Disney Studios. That team includes, among others, Art Cruickshank, Eustace Lycett and Danny Lee (who is in charge of special effects, per se, *and who made all the models which I designed). All these people are Academy Award winners and very important on this picture, so I'm not the big honcho who knows it all. Ever since Walt Disney was alive we've had this system wherein we've all worked together very closely and it really works well.*

QUESTION: You've worked on a great many Walt Disney productions over

Ellenshaw adds finishing touches to a model of the U.S.S. Palamino, the relatively small spaceship that finds the missing Cygnus deep in space.



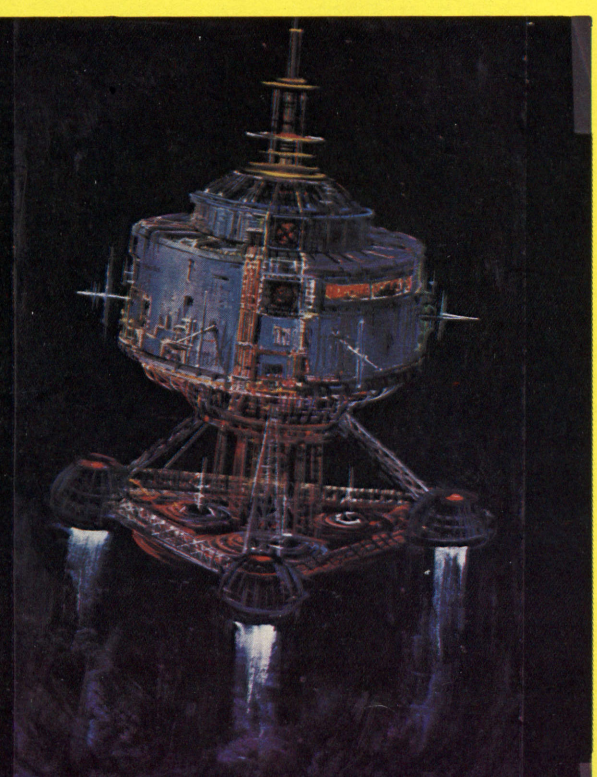
Peter Ellenshaw's intricate design rendering of an exterior portion of the U.S.S. Cygnus, an imposing spacecraft supposedly three-quarters of a mile long. It is characterized as a derelict ship, missing for more than 20 years and poised precariously on the lip of a Black Hole. The design marks a departure from the familiar "slab-sided spacecraft" in that its "skeleton" is on the outside of the ship and accessible to repair. Ellenshaw was inspired toward this "ektoskeleton" concept by the radio telescopes of the Goldstone Tracking Center.

the years. Can you tell me how THE BLACK HOLE compares to others that you've made at the studio?

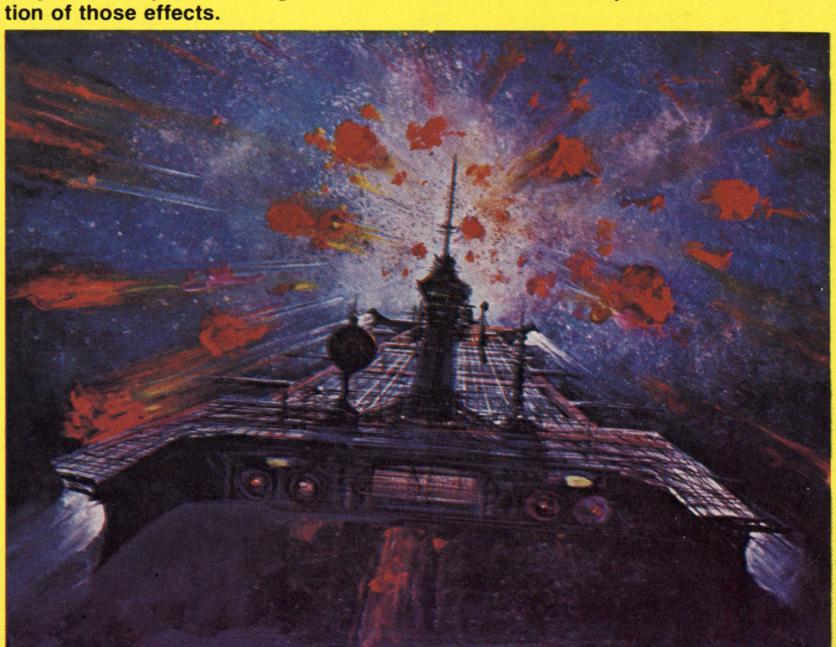
ELLENSHAW: THE BLACK HOLE has been quite different from any picture we've made up until now, because we've been attempting things we've never tried before. We are now getting down to what might be called the "nitty-gritty", because as we got through the Black Hole, everyone is expecting something spectacular to happen, and to make that spectacular thing happen is the big problem we are faced with at this time.

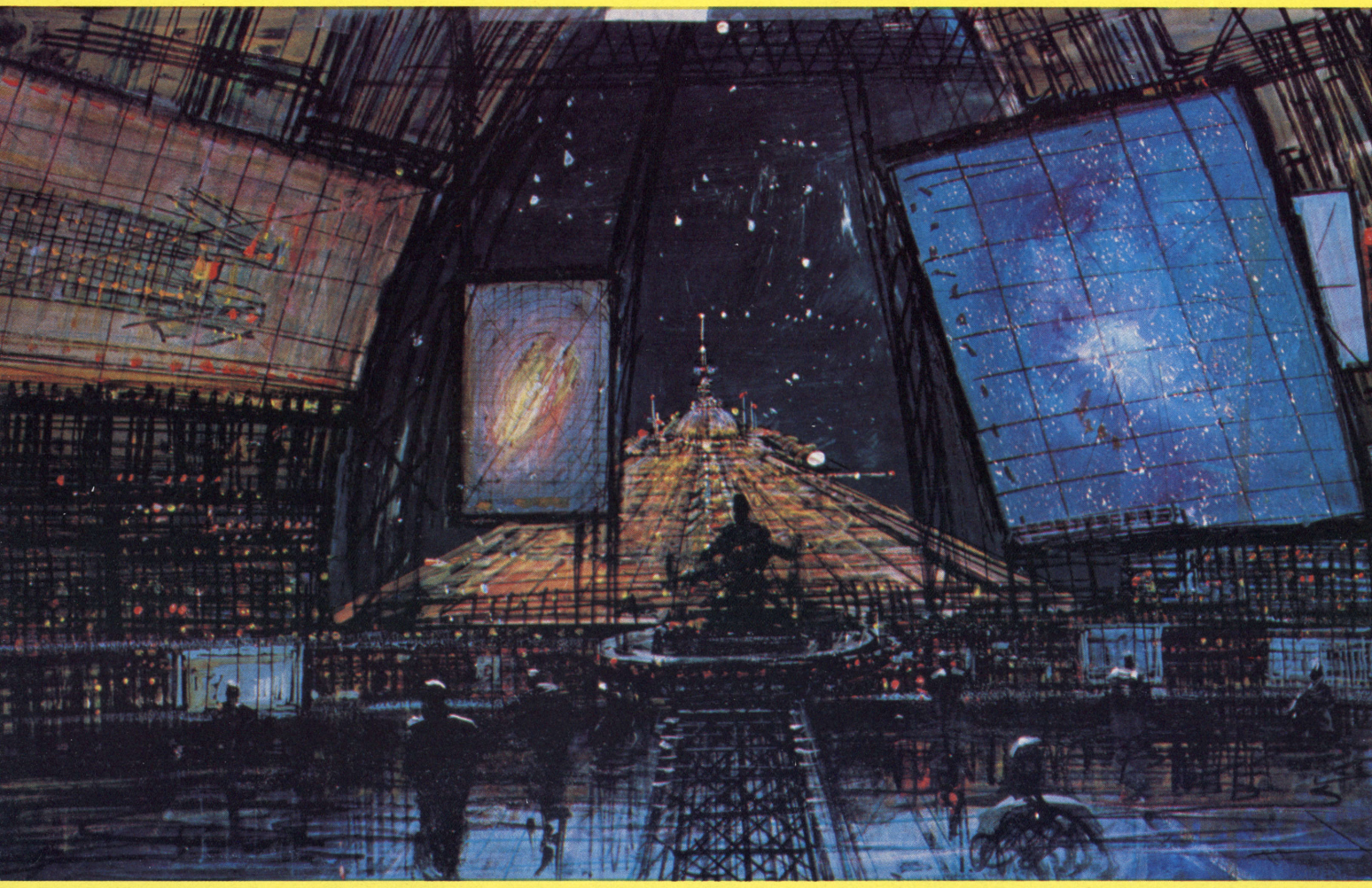
QUESTION: Can you tell me how you first got involved with the project?

ELLENSHAW: Recounting how I got involved in working on THE BLACK HOLE, I have to say that I had worked at Disney Studios from 1953 up until Walt died. After that I became very heavily engaged in painting pictures for sale and that became a large part of my life. I found that I just couldn't keep up with both careers, so I moved up to Santa Barbara to live, but occasionally I was called back and tempted with exciting projects, the last one of which was ISLAND AT THE TOP OF THE WORLD, with Winston Hibler as producer. Hibler and I got on beautifully together and it was a sad loss when he died, but I had promised him that when it came time to work on his space



(LEFT) Design rendering of the U.S.S. Palamino, the craft which discovers the Cygnus languishing in deep space. (RIGHT) Design sketch showing the Cygnus under bombardment by a shower of meteors. Ellenshaw's extensive experience with special photographic effects made it possible for him to indicate such effects very accurately in his designs, which became almost "blueprints" for the execution of those effects.





Design sketch for the Command Module interior of the U.S.S. Cygnus. The entire design concept of THE BLACK HOLE is predicated on low-key lighting, the rationale being that all of the action takes place outside the solar system—a locale which is lit by starlight rather than by a single sun. This is a marked departure from most space films (with the exception of ALIEN) which take place in the solar system, illuminated by the bright single source of the sun.

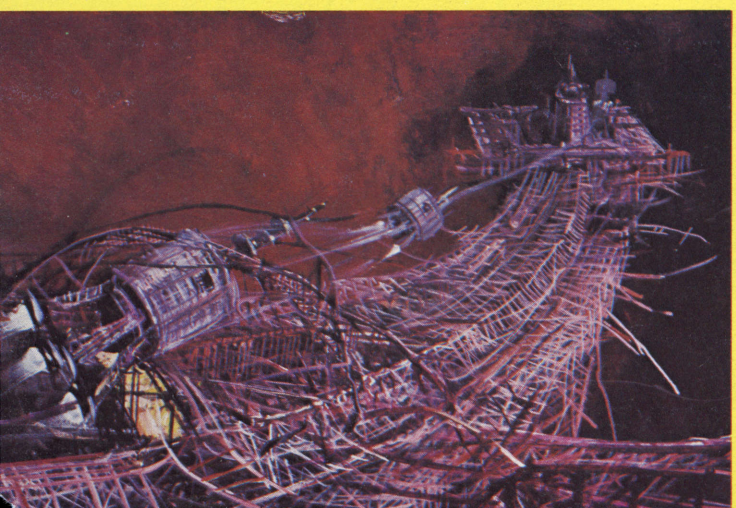
picture (which turned out to be THE BLACK HOLE) I would certainly work with him, because I loved him and he was a great man to work with. In any case, he had gotten me interested in the picture and before he died I would come along and discuss it with him and reassure him that I would work on it. I had thought that it would probably take 18 months out of my life, but here it is now more than three years and we still haven't solved all the problems. I'm convinced that we will solve them; we have to solve them. The real question is whether we can solve them in time to get the picture out for Christmas, and that hangs over our heads constantly. It's always a nuisance when you have a picture of this type where you have to keep to a regular schedule. That's the worst part, but I certainly intend for us to finish in time and I know that we will.

QUESTION: Three years seems to me an incredibly long time to be working on the same film project, even by Hollywood standards. Was it the complexity of the production design that took that long?

ELLENSHAW: The story of the picture changed a great deal as we went through the months and that's one of the reasons that the project was in the works so long. The design didn't take three

Continued on Page 76

Design rendering of the Palamino escaping from the Cygnus, as the large ship is torn to pieces by the Black Hole. Although technical detail indicated in the film is based on scientific research into what is known about Black Holes, the available information is so limited and rudimentary that the artists and artisans on the picture had almost free rein to let their imaginations soar—with exciting results.



PHOTOGRAPHING "THE BLACK HOLE"

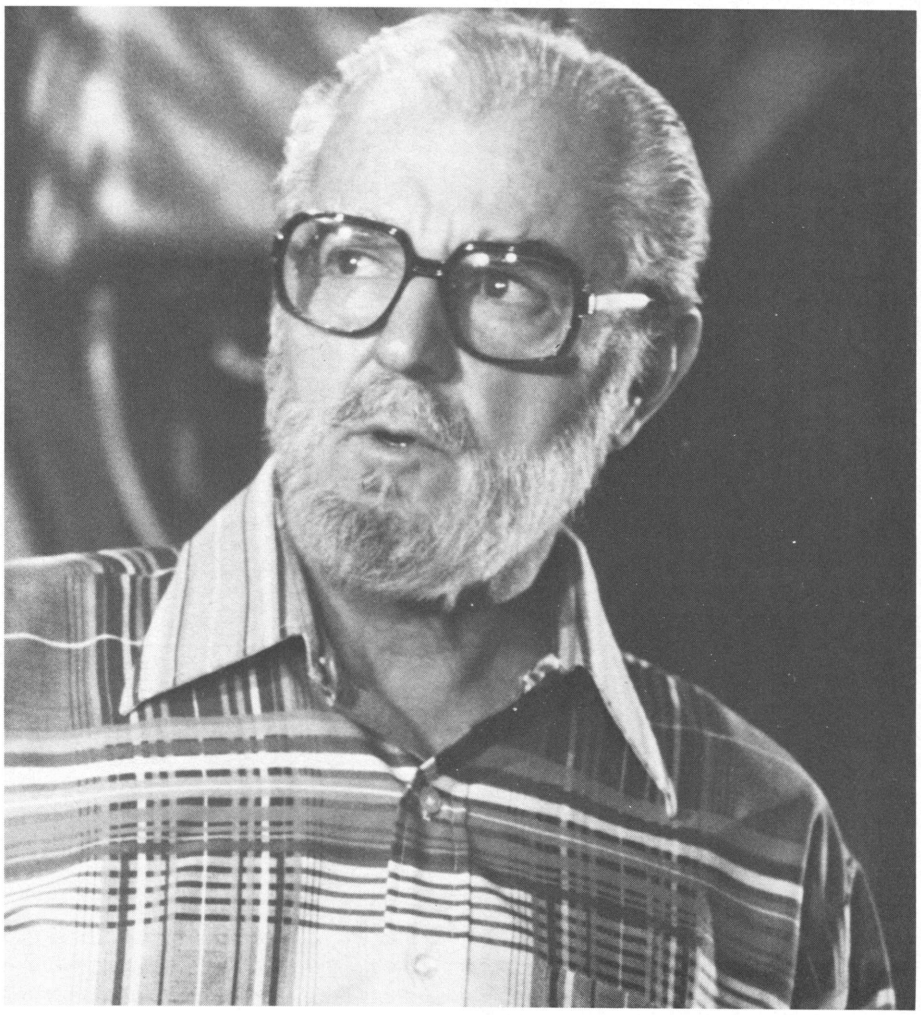
The many challenges included photographing what happens inside a Black Hole, simulating laser beams and a hologram, and shooting live action to tie in with special effects not yet in existence

The "Golden Era" of Hollywood was noted for films having a great deal of production value. This look was the result of shot-by-shot craftsmanship under the direction of artists and technicians who learned and perfected their skills under the aegis of the major studios. Frank Phillips, ASC, is one of the remaining practitioners of this style of studio production cinematography.

Phillips joined the industry as a camera loader for MGM in the mid-30's and has worked behind the camera with Harry Stradling, ASC, Charles Rosher, ASC, and Joseph Ruttenberg, ASC. His career includes assignments under directors Gene Kelly, Stanley Donan, Busby Berkely, George Stevens and Robert Stevenson. He was personally selected by Darryl F. Zanuck for his first cinematographic assignment on THE RACERS.

Then came Disney. Phillips has held Director of Photography assignments on more than twenty Disney features including SCANDALOUS JOHN, BEDKNOBS AND BROOMSTICKS, ISLAND AT THE TOP OF THE WORLD, THE APPLE DUMPLING GANG, ESCAPE TO WITCH MOUNTAIN and PETE'S DRAGON. On these and other productions he was among those most responsible for maintaining the Disney "big studio" look.

These were the skills executive producer Ron Miller and director Gary Nelson needed when they selected Phillips to handle the behind-the-camera chores for Walt Disney Productions on their epic $20 million deep-space adventure, THE BLACK HOLE.



Frank Phillips, ASC, Director of Photography on THE BLACK HOLE, is a veteran of many Disney features, but found this latest to be among the most challenging. (BELOW) Phillips in a conference with Director Gary Nelson (holding camera), who, he says, was "a perfectionist who was right on top of this picture all the way through."

QUESTION: What was your initial reaction when you were given the assignment as Director of Photography on THE BLACK HOLE?

PHILLIPS: That it would be a fantastic challenge for me, as cinematographer. It certainly turned out to be that, but I have come to expect such challenges from the Disney Studios. On this picture, because of the many intricate special effects, the problems were doubly complex. I had to shoot scenes somewhat blind and then hope that the special effects people would come along and match their effects to it. That's where Peter Ellenshaw, the Production Designer, was very helpful. He is a master at that sort of thing and he worked very closely with us to make

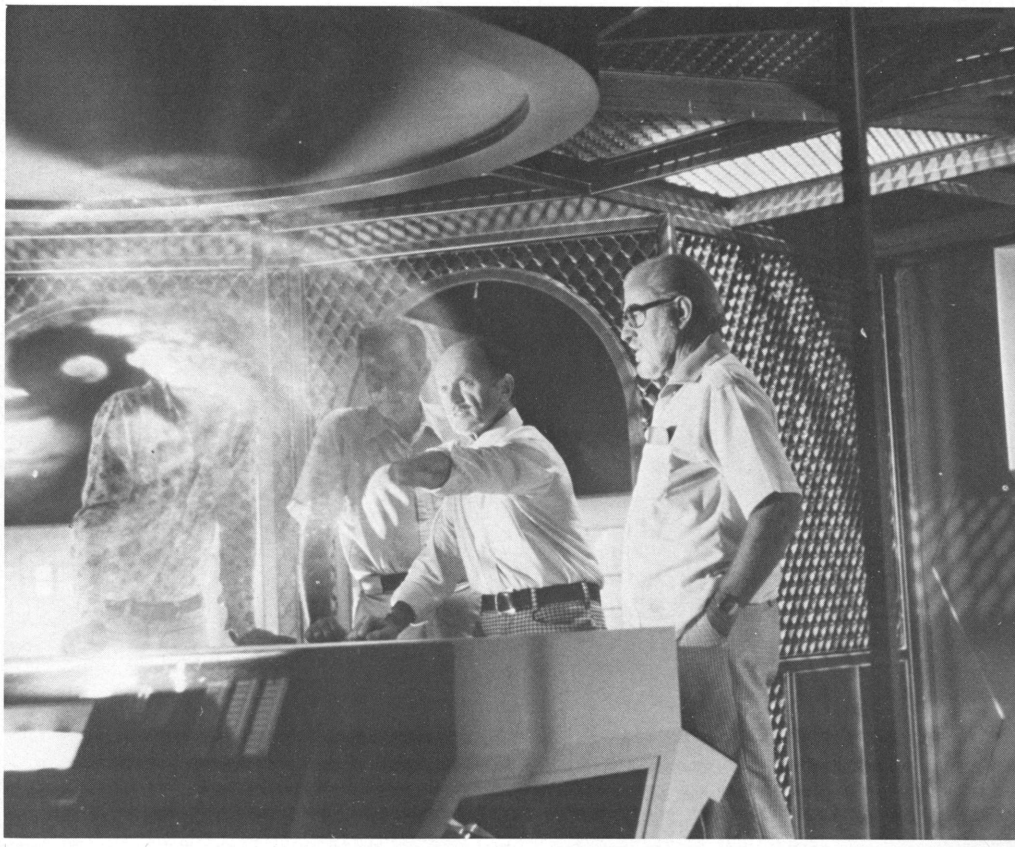
sure that the live photography and the effects would blend evenly. The director, Gary Nelson, is one of the brightest guys to come along in a long time. He was really on top of the picture all the time. He knew just what he wanted and we tried to give it to him.

QUESTION: In terms of lighting, isn't THE BLACK HOLE quite a departure from the usual high-key Disney style?

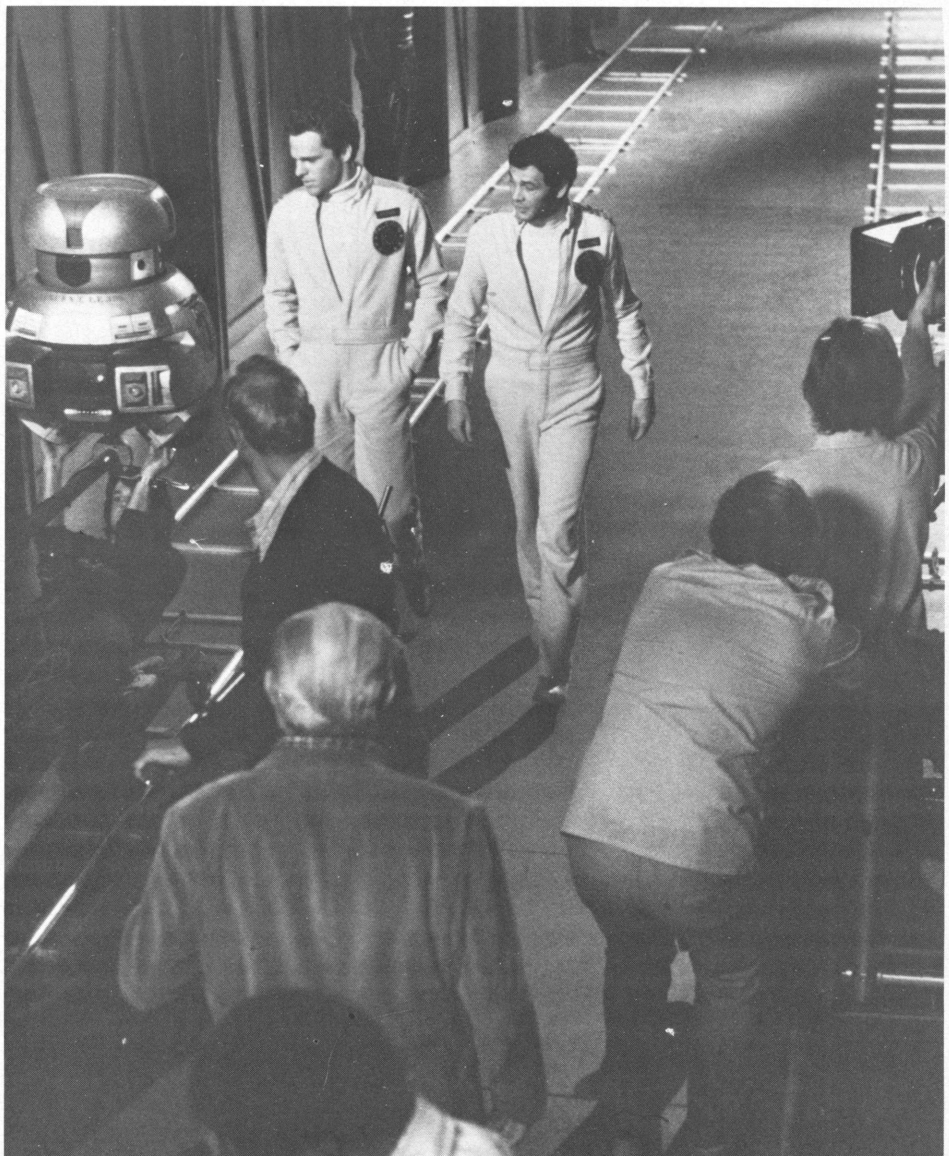
PHILLIPS: Yes. Most Disney films are bright simply because they are light comedies. But in this case, the producer and director wanted a very low-key lighting effect, since the story was taking place in the extremities of outer space. Because there was no direct sunlight, they figured that everything should have a real down mood. Even inside the huge spaceship called the Cygnus there were no practical lights showing at all, except in the beautiful English manor type dining room, where we had a crystal chandelier. Otherwise there were no practical lights visible at all, other than those on computer units or other service equipment. That being the case, we tried to hold to a very low-key "mysterioso" style of lighting as much as possible.

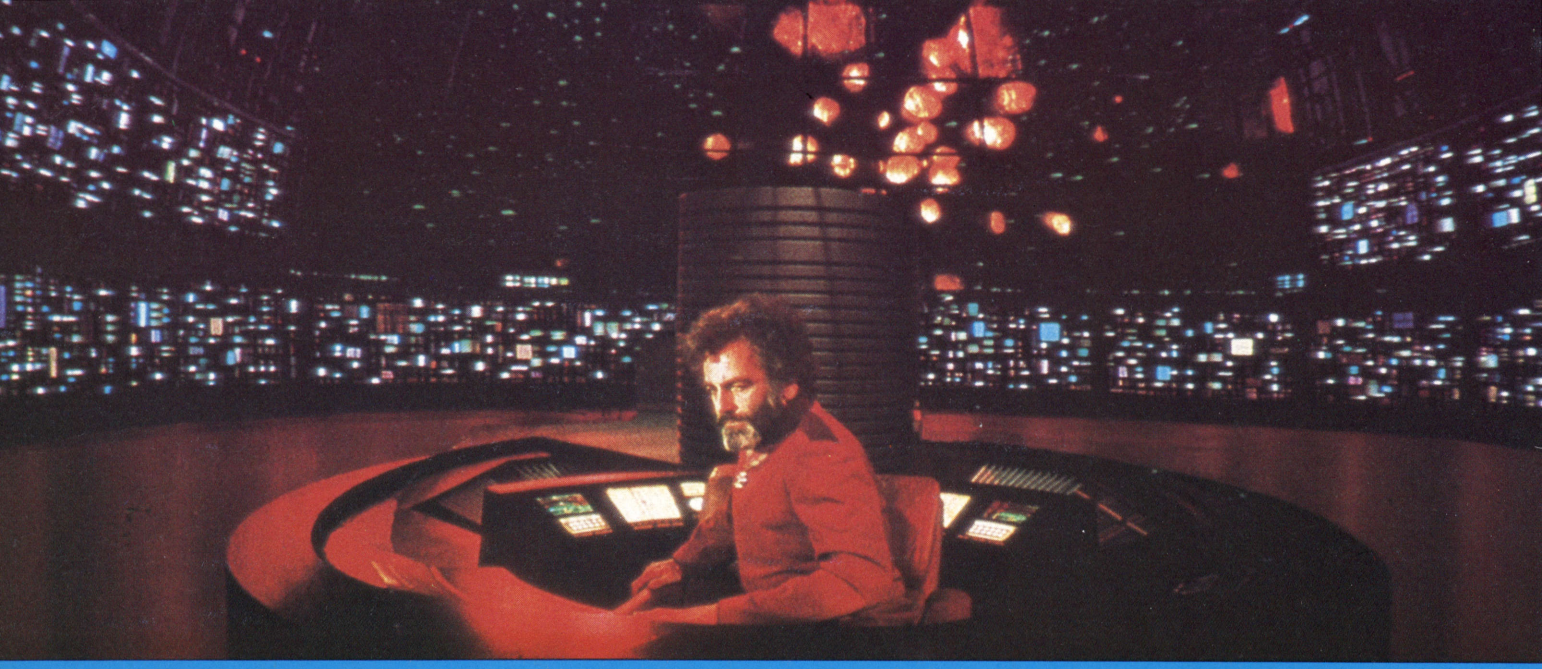
QUESTION: Can you tell me a bit more about the problems of matching your lighting to the special effects?

PHILLIPS: The biggest problem in integrating our lighting effects with the special effects was that we were doing our effects before they did theirs: Even though we had renderings that gave us a fair idea of what was required, sometimes the colors in the effects weren't as strong as, or were stronger than, ours. It was question of guessing a lot of the time and, hopefully, coming out even with them—and in most cases we did. For example, there was one scene in which a spaceship blasts off in front of people standing there. This was shot in front of a blue screen, with a miniature of the spaceship blasting off to be composited later. I tried to simulate the effect of the afterburner light on the people's faces and bodies as the then non-existent spaceship flashed by, but there was no way of knowing how much afterburner light would be coming out of the miniature. It turned out, when they finally made their min5ature, that I had more effect than they wanted. They had decided by then that, instead of a flashing light, they wanted more of a steady blue flame. Obviously some changes had to be made. But that was the hardest part—knowing how far to go. Some of the effects were very, very strong, but in most of those cases I had a hunch and went as strong



Production Designer Peter Ellenshaw and Phillips discuss a simulated "hologram" effect created by projecting an image onto glass. (BELOW) During a long dolly shot, an assistant supports from underneath a robot that is supposed to be floating in air. This method, wires and "teeter-totters" were all used to create the floating effect in various situations.





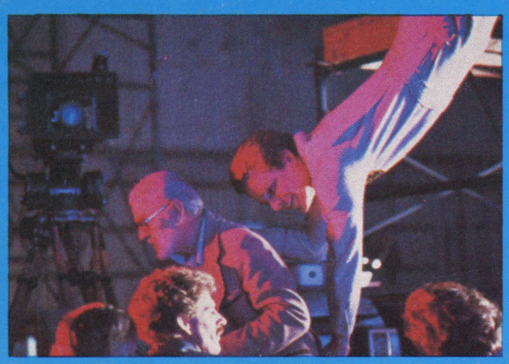
Maximilian Schell plays the role of Dr. Hans Reinhardt, a research scientist obsessed with the idea of passage through the Black Hole. The huge derelict spacecraft, U.S.S. Cygnus, has become Reinhardt's domain, patrolled by robots and shadowy human-like creatures. Huge sets like this Command Module filled entire sound stages at Disney Studios and required a tremendous amount of lighting, even though the style of photography was low-key.

as I thought I could. It usually worked out pretty well. It was a picture on which we had to have complete coordination with Peter Ellenshaw, Art Cruickshank and Eustace Lycett as to exactly what they were planning and what we could do on the set to match that.

QUESTION: How much opportunity did you have to pre-plan for the shooting of THE BLACK HOLE?

PHILLIPS: I had quite a bit of preparation time—more than a month—and I was on the picture a total of seven and a half months, most of which was shooting. It took a great deal of planning from the electrical standpoint. We had such huge sets (most of them filled an entire stage) and we were short of stage space at Disney Studios, so we had to plan ahead and have all our rigging done in just a short time before we were scheduled to shoot. Some of the effects required multiple arcs and shutters and flashing lights, so we had to be careful to get the right equipment, which we did. I had a wonderful gaffer, Carl Boles, who is great at the logistics of all this. He was always ahead of us no matter what we needed and he did a magnificent job. We had really huge lighting effects. The spaceship Cygnus itself, in real life, was supposed to be three-quarters of a mile long, so the sets naturally had to be vast. We had a director who was a perfectionist about everything, and we tried to give him what he wanted. But everything worked very well. I was delighted with the results.

Phillips prepares to film Joe Bottoms in a weightless sequence during the destruction of the Cygnus.



QUESTION: Going back to what you said about there being no practical lights in the sets, did that hamper you or did it give you more freedom to create a source wherever you felt it should be?

PHILLIPS: No, it didn't hamper me. It's just that I'm used to lighting to an indicated source. If I see a practical light in a set, I automatically light from that source. But when you have nothing, it sort of taxes your mind for a few minutes to figure out what you want to do with it. The decision is not all that difficult to make; it's just that having a practical source makes it a bit easier. In this case, it gave us a little more challenge to figure out what would be the most effective light, without seeing a light in the picture.

QUESTION: Most outer space films have to cope with the "weightless" situation, at least during portions of the action, and I would assume that THE BLACK HOLE had its share of weightlessness. How did you handle that problem photographically?

PHILLIPS: The early part of the picture was all zero gravity, so everyone was either hanging from wires or balanced on devices we called "teeter-totters" to create an illusion of floating. We would sometimes have a whole crowd of characters—the actors and the robots—all rushing for an entrance or exit, and we would be rushing along dollying with them and floating the robots. It was tough on the camera operator, because he had to miss all the teeter-totter apparatus underneath or above, but he did it.

QUESTION: How did you manage to hide the wires?

PHILLIPS: We had lots of wire work, but even so, we tried to avoid wires whenever possible. Lighting around them is a very difficult thing. You can use paint to blend them into the background and, if the background is dark, it works, but there are times when you have to just hold your breath. In one sequence we had an extremely hot background—pure white steam, pulsating lights, everything on a white background. Now, under conditions like that, you can paint the wires as white as possible and they still won't disappear. So we had to use teeter-totters to float the people. We had this one shot where we had to take four people and two robots all the way across a big set in a dolly shot with no wires, but a lot of other apparatus. But when you do use wires, it's all a matter of painting and shading them into the background and, hopefully, getting some vertical lines in the set to help hide them. Even so, I really don't think you'll ever see a wire in THE BLACK HOLE. At least, I haven't seen

one. But someone who is looking for them is bound to find one somewhere.

QUESTION: There are quite a few laser effects in the picture. Did you use any actual lasers?

PHILLIPS: No, we didn't use any real laser lights. We tested some, but they were too dangerous to use with the actors. We simulated our own laser beams and the simulation looks almost like the real thing. The animation people at Disney Studios got so close to the real thing that it was incredible and, in some ways, even better.

QUESTION: Did you use holography in the picture?

PHILLIPS: Early in the story we simulated a hologram and it was a most interesting shot. Usually such an effect would be created by optical printing in the lab, but we did it with rear projection of a reflection onto a plate glass in front of the camera. The basic approach was nothing new actually, but we had to rig it so that people could walk to the side or behind it and so that we could move the camera some. The real trick was to keep the image of the hologram off of the backs of the actors as they crossed through it. Usually this would be done in a matte shot, but we used rear projection and had Art Cruickshank and Eustace Lycett mask out the image as people walked in front of the camera, so that there was no image on their backs. I lit everything dimly, so that the "hologram" would read clearly. In fact, when it appeared, I dimmed the other lights so that it would read against the background. I was very happy with the effect.

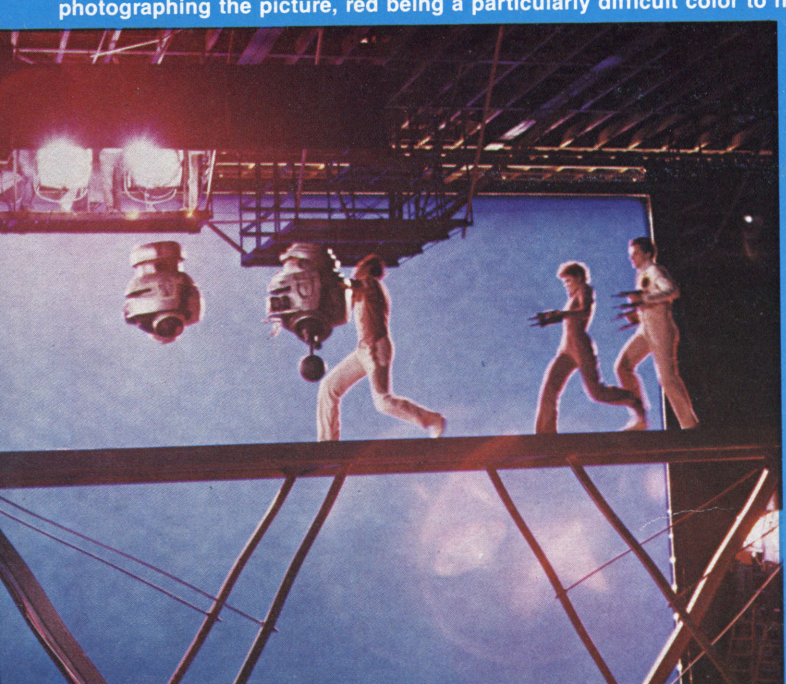
Anthony Perkins, playing role of the scientific chief of the explorer spacecraft Palamino, stands behind a "hologram", which was simulated by projecting an image onto a plate of glass in front of the camera. This is an effect that would ordinarily have been created in the optical printer. All of the set lights had to be dimmed so that the projected image would read well.

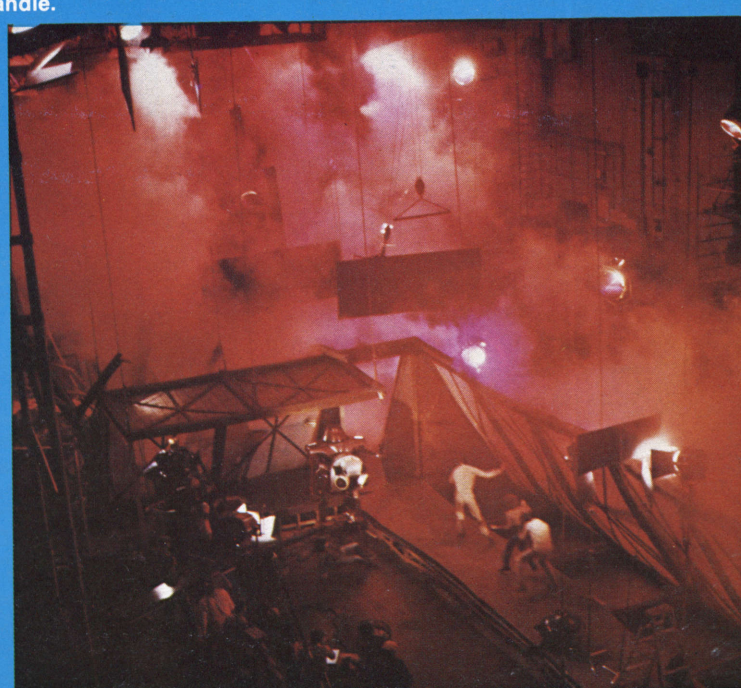
QUESTION: In addition to the Cygnus, what were the other major sets that you had to light?

PHILLIPS: The first explorer ship (Palamino) was really a beautiful set. Very workable. Not the easiest thing to light, because it had a solid curved ceiling piece on top. But it was worth it. It looks great. Then there was the Probe Ship. At the end of the picture it becomes separated from the Cygnus and is being pulled into the Black Hole. For that sequence, Gary Nelson had devised a set that tumbled completely, but he also wanted the camera inside to revolve in the other direction. So we had a tumbling set and a revolving camera, and the quarters were so close that it took me eight hours to mount that camera—the longest time I've ever taken for a camera set-up. There was so little tolerance with this huge thing spinning around that it was missing the back of the camera by only 3/4ths of an inch. With all the terrible force of the thing going around, the camera was that close to being sheared off. But my Key Grip, Don Kapel, is a master at putting that sort of thing together. He does wonders with aluminum tubing and all those precision fittings.

QUESTION: It would seem that on this

(LEFT) Robert Forster, Yvette Mimieux and Joe Bottoms, crew members of the Palamino, plus two floating robots, make a mad dash in front of a blue screen for a scene, which, when composited with the background scene, will show them running through the main corridor of the Cygnus. (RIGHT) Fiery red light suffuses the set, as the Cygnus is drawn into the Black Hole. A great deal of colored light was used in photographing the picture, red being a particularly difficult color to handle.





picture there was considerable blue screen filming. Did that present any special problems?

PHILLIPS: Blue screen is always a problem in that you have to keep shiny surfaces from picking up reflections of the blue. Also, smoke and steam will usually give you trouble. At the end of the picture when the big spaceship is being pulled into the Black Hole, we had a tremendous set full of steam and smoke, and we simulated all the red and green and other colors that seemed appropriate to a Black Hole crisis. Art Cruickshank told me that the steam and smoke didn't bother him at all, for some reason. It's something that you can never really be sure of with blue screen, but in this case, it was either opaque enough or the red color of the smoke and the red background made it blend very well, but it photographed beautifully.

QUESTION: Since you've worked at Disney Studios for many years, you have used the sodium light process for matting quite a lot. Why the extensive use of blue screen instead of the sodium light process this time?

PHILLIPS: That's a good question, but I think it's because blue screen is more flexible for a subject like this. For one thing, the screen is bigger. Also, with sodium you are limited to just vertical shots, whereas the blue screen allows you to shoot down or up or any way. Sodium has its limitations; however, it does make its own traveling mattes. From my standpoint, I'd rather use blue screen, because sodium requires an immense amount of light. With sodium, I was up to 400, 500 and 600 footcandles and that amount of light is awfully hard to use on interiors, because the light gets so brassy. So I'd much rather work on blue screen and I think that Art and Eustace, especially with the new blue screens that we now have, probably feel the same way.

QUESTION: In order to illuminate the huge sets that you had to shoot, what kind of lighting units did you use for your overall generalized lighting?

PHILLIPS: Well, there were many, many 10Ks, naturally. Of course, I was lighting to a very, very low key—much lower than usual. Basically, in terms of footcandles, I was down to 60 or 70 at the very most, and for some of the stuff that I shot in the Probe Ship at the end, I was down to 20 footcandles on the faces. Extraneous colored light coming through the windows and portholes probably built the exposure up a little more in spots.

Frank Phillips casts a quizzical eye on a robot about to be filmed. (BELOW) For a sequence at the end of the picture showing the Probe Ship tearing loose from the Cygnus, a set was devised that tumbled end over end, but the director wanted the camera inside the revolve in the opposite direction. The quarters were so close it took eight hours to mount the camera—with only 3/4ths of an inch clearance between tumbling set and camera.

QUESTION: Did you use any HMI lighting?

PHILLIPS: I didn't use any on this picture, although they are very fine lights. I did a film recently on which I used them extensively and they are really great. They are cool, lightweight and easy to use. I was very happy with them and I'll probably be using them a lot more.

QUESTION: Did you force-develop on this picture at all?

PHILLIPS: Very, very seldom, because of the nature of the picture, with so many matte paintings and all the optical work. I

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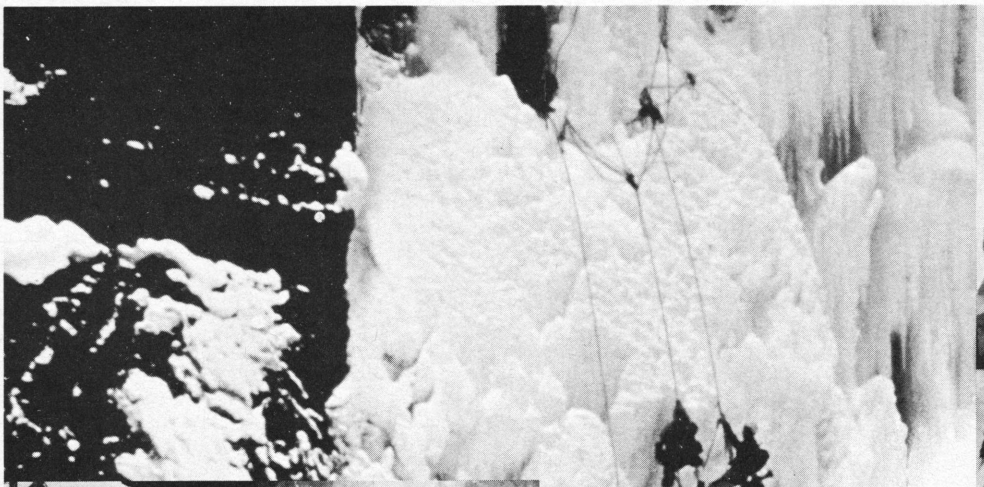
ECLAIR ACL: the rugged reliable quiet camera

ABC Sports selected three cameramen to shoot Bridalveil Falls: All three owned ECLAIR ACL's.



ABC Sports Bridalveil film crew:
cameraman/director—Scott Ransom
cameramen—Bob Carmichael, Greg Lowe
Soundman—Peter Palafian

Bob Carmichael, one of the cameramen who climbed the 500 ft. high frozen waterfall had the following to say about his new ECLAIR ACL:

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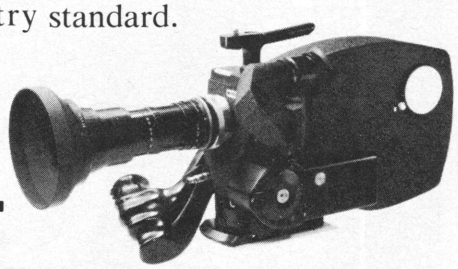
ECLAIR ACL: the dependable quiet one



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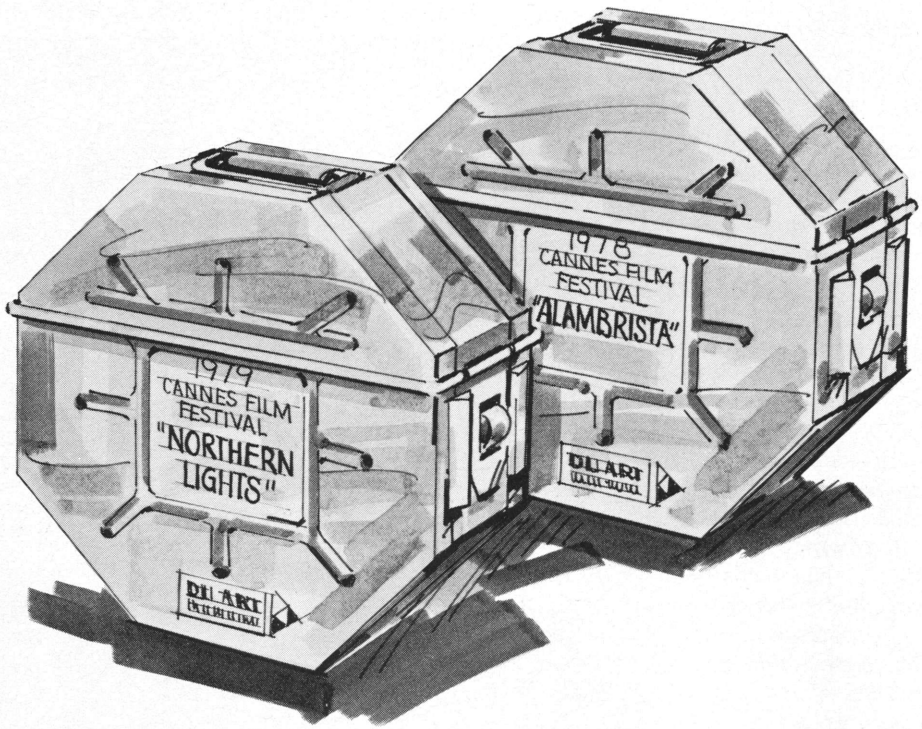

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THE PRODUCER TALKS ABOUT "THE BLACK HOLE"

After almost five years in various stages of gestation, with a shift from the Disney formula, the most ambitious film the studio has made

Ron Miller, Producer of THE BLACK HOLE, started at Disney Studios in 1957 as a second assistant director and a dozen years later became the studio's executive producer.

In 1976, he was elected the company's executive vice president in charge of production and creative affairs. He supervises all film and TV production and is a member of the board of directors and the three-man executive committee.

He was an associate producer on the Sunday night TV shows and on several features before becoming a co-producer.

His first movie with full producer credit was NEVER A DULL MOMENT, which has been followed by a steady succession of films, the most recent of which include THE RESCUERS, PETE'S DRAGON, HOT LEAD AND COLD FEET, THE CAT FROM OUTER SPACE, UNIDENTIFIED FLYING ODDBALL, THE APPLE DUMPLING GANG RIDES AGAIN and THE BLACK HOLE.

In the interview for *American Cinematographer* which follows, Ron Miller talks about how THE BLACK HOLE evolved, the problems involved in making it, and how he hopes it will impress audiences:

QUESTION: From your viewpoint as Producer, what would you say was the major challenge in making THE BLACK HOLE?

MILLER: The major challenge—aside from trying to make an exciting movie—was to come in as close as possible to being on budget, which we pretty much did. In this day and age, coming that close to hitting the budget is a tremendous accomplishment, especially considering all of the tricky special effects that were involved. But the effects are spectacular, the miniatures are outstanding and the acting is excellent. There are only a half-dozen human characters involved, but the film has the feeling of a very big, big picture.

QUESTION: How did you arrive at the visualization of the Black Hole that appears on the screen?

MILLER: What appears on the screen is our interpretation, based on available research, of what a Black Hole should look like. Since no one has actually seen one, we felt free to go with our interpretation.

QUESTION: Even though the subject is very timely, I understand that your film has been in the works for four or five years. Is that correct?

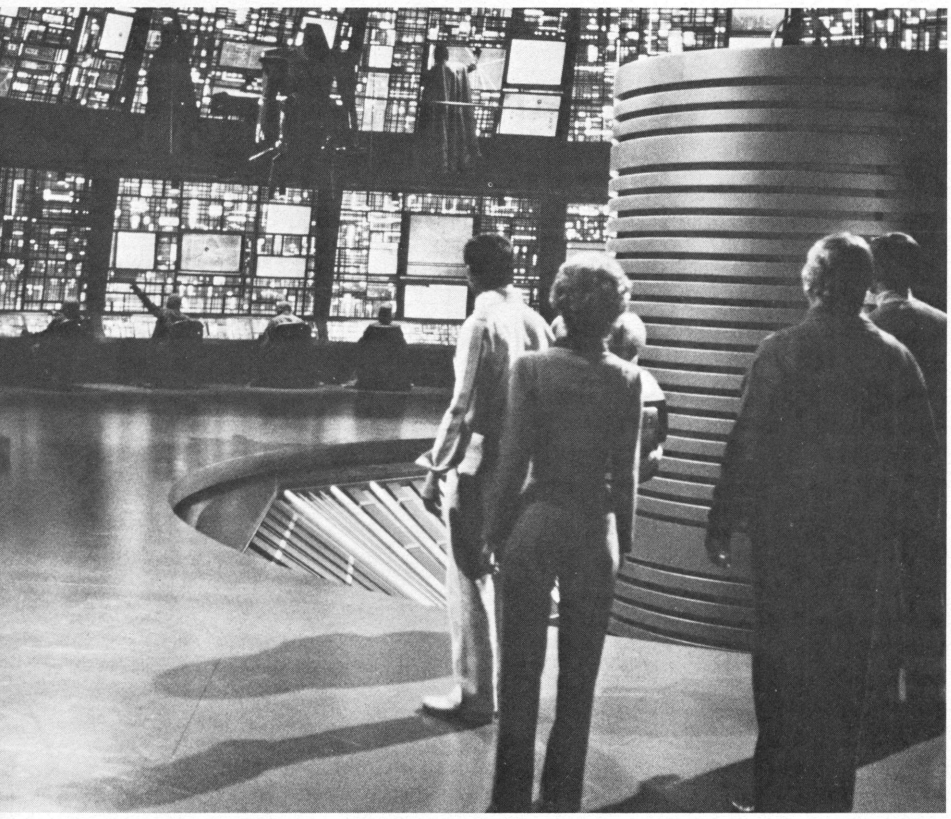
MILLER: Yes. When the two original writers came to me in my office and submitted a nine-page outline—actually an oral presentation with some renderings and such—that was almost five years ago. We've taken a lot of twists and turns to get where we are now, but there is no similarity between what we've finally arrived at and the original story that we bought almost five years ago.

QUESTION: How did you arrive at a choice for a director?

MILLER: In the beginning another director was assigned to the project, but he left because we didn't know exactly where we were going at that time. Then, when we started up again, he was busy on another picture. So we chose Gary Nelson, who had done a couple of outstanding things for us previously, and he's done another outstanding job on THE BLACK HOLE. It has been probably one of the most challenging assignments ever for a director, because of all the technical complications and the many pieces of film involved in most of the

Ron Miller, Producer of THE BLACK HOLE, which started out to be a typical Disney formula ("boy and his dog") vehicle when it was first contemplated almost five years ago. In the interim, different writers, a different director and a different segment of the sought-after audience have combined to change the story line completely from its original thrust.

Disney Studios is one of the few self-contained technical entities capable of producing a film on as vast a scale as THE BLACK HOLE—mostly due to the cadre of exceptionally talented artists and craftsmen on its staff. Here are some of them who worked on THE BLACK HOLE including, in the foreground, Art Cruickshank and Peter Ellenshaw, two of the Academy Award winners involved. (BELOW) A scene aboard the derelict spaceship U.S.S. Cygnus.



shots. There are intricate special effects, mattes, blue screens, everything—but perhaps his greatest challenge was getting the picture completed in time for the December 20th release.

QUESTION: What is your release pattern on this picture?

MILLER: When we made the decision that we would release it on December 20th it didn't appear that we would be able to get any 70mm prints by that date, because—and this is something I didn't realize—the lab can produce only one 70mm print a day. It's a time-consuming process. Since we were planning to go multiple with 500 to 700 prints, that presented a serious problem, even though all of those theaters are not equipped for 70mm presentation. When we realized the scheduling problem, we concentrated on getting two 70mm prints—one for the World Premiere in London on December 18th (actually a Royal Command Performance for Prince Philip), and the other for the Hollywood Premiere on December 20th, a benefit for the California Institute of the Arts.

COMMENT: Referring back to what you said about the original story having been brought to you almost five years ago, I should say that, even for a film of considerable technical complexity, a gestation period of five years is quite a long time.

MILLER: Yes, it is a long time, and when you spend that much time developing a project you become very uneasy about it. I know that in the past, a lot of the projects it took that long to develop we should never have done in the first place. In this case, the story we started off with was sort of weak. We tried to force a kid and animals into it to make it a sort of Disney science-fiction situation in which the Black Hole was nothing that we actually dealt with. At the time, we needed a robot to go into the Black Hole and come out with a flower, which proved that there was life in there—but the Black Hole had nothing really to do with our story. In the film as it finally evolved, we have a group of five people probing space who come upon a Black Hole. What interests them, however, is a spaceship which has been missing for 25 years. A sort of ghost ship, it is based right at the edge of the Black Hole. Well, immediately that story line took on a whole different entertainment aspect, and it led us to where we are today.

COMMENT: In other words, instead of trying to force the typical "cute" Disney elements into it, what you have now is more or less of a serious science-fiction film.

MILLER: We've got a cute robot, but we don't have any children. We've certainly got our special effects team, which is typical Disney, but I feel that they've outdone themselves in this picture. I also feel strongly that this picture is going to be appealing and entertaining to all age groups, including the age group which, for one reason or another, we haven't been able to get to recently.

QUESTION: Do you feel that because

Continued on Page 94

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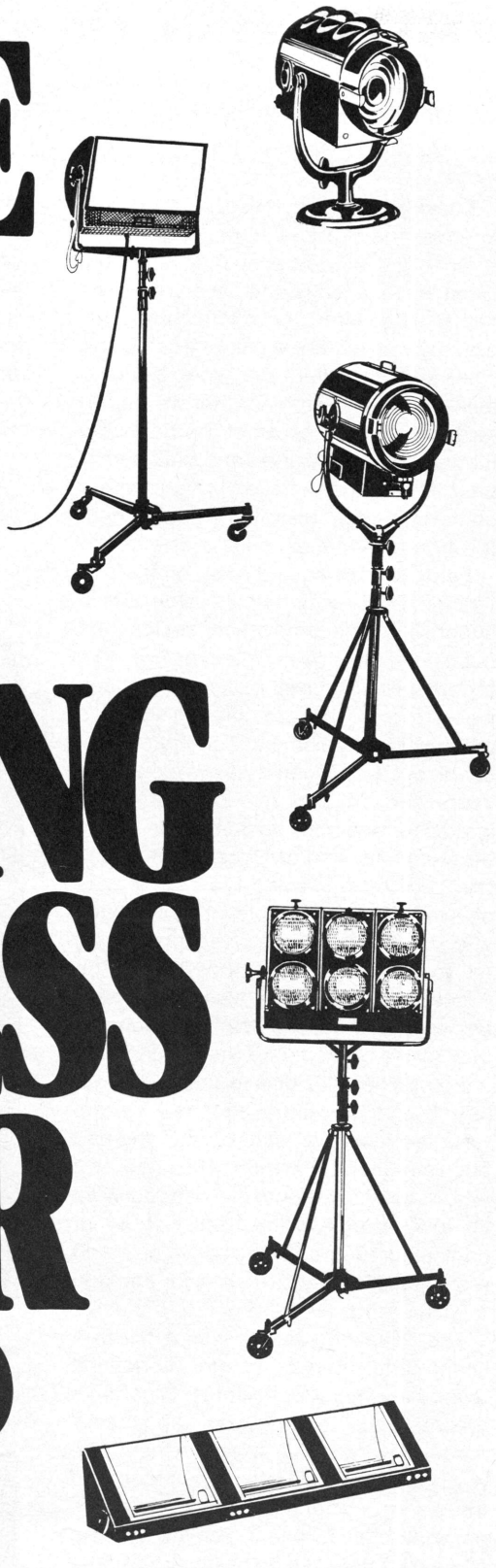

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TWO YEARS OF DIRECTING "THE BLACK HOLE"

By GARY NELSON
Director

His complex assignment began long before the cameras started rolling and continued long after they had stopped—almost a career in itself

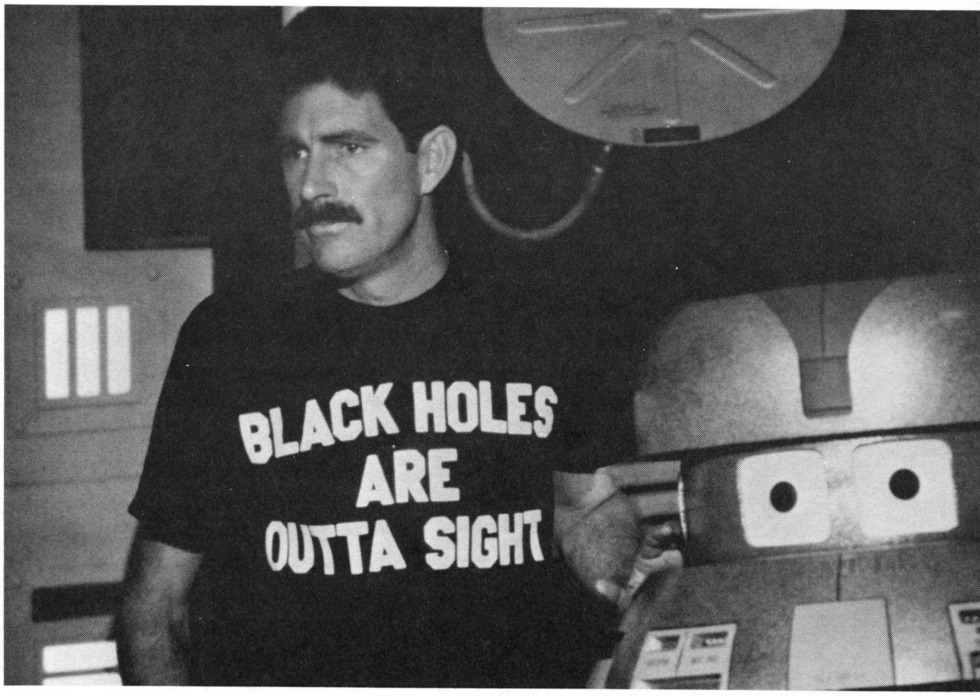
I have worked on THE BLACK HOLE for two years and the major problem when I first started was that we really didn't have a story that everyone was happy with. After about four months of working with writers, we finally settled on what kind of picture we were going to make. The next problem that we had to face was to salvage all of the hardware that had been designed and built a year prior to that and get everything together so that we could make a picture without having to completely start over.

Peter Ellenshaw had been on the picture for about a year before I came onto it, supervising the production design and building models. We wanted, as I've said, to retain what he had built, even though we were going to film a different story. It's really not fair to comment on the original script, because when it was written—five years ago, or perhaps longer—it was written for a specific audience and was to be a specific kind of Disney film. When the producer passed away it was shelved. Then a couple of years later, after STAR WARS was released, Disney revived the project and it was felt that the concept they had approved three years before might not be right for the audience they would be going for the second time around. They decided to make it a different kind of picture and new writers were brought in to work on it. They had been struggling with the script for about a year before I came onto the picture. I went to work with the writers and Ron Miller and some other people and we came up with a satisfactory story line for the kind of picture that we were going to make.

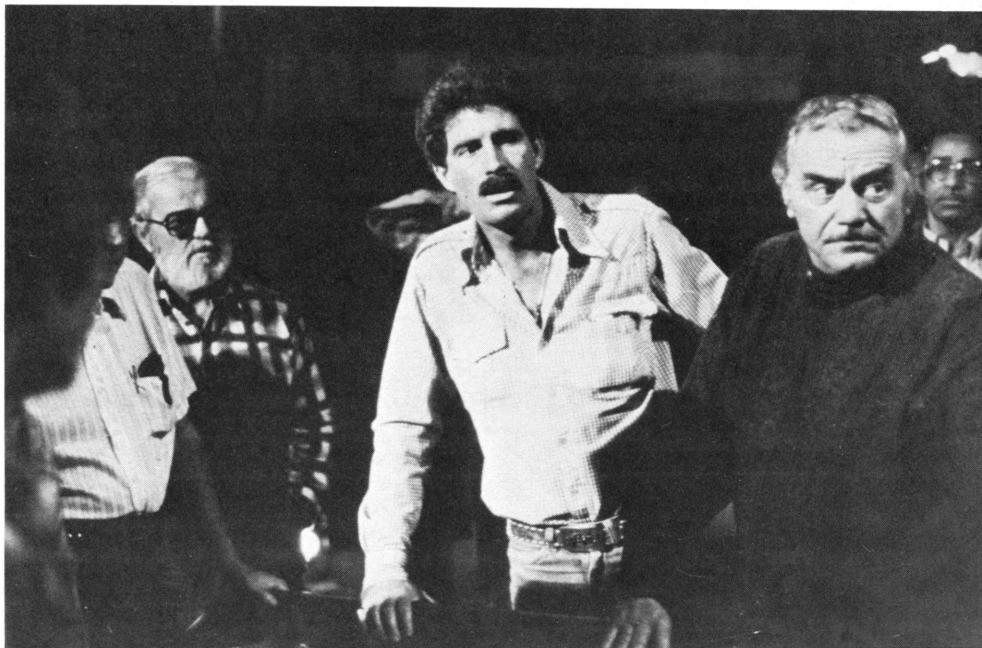
The scientific input for writing the new script came from all of the information available, including Albert Einstein's theories about the Black Hole and artists' renderings based on scientific theory regarding the Black Hole. The majority of those in the scientific community agree on what a Black Hole is, but the concept of what it might *look* like—especially the rotating Black Hole—is really up to the imagination. That gave us a rather free hand and it's the reason why we were able to conceive our visualization of a Black Hole as exciting as it should be.

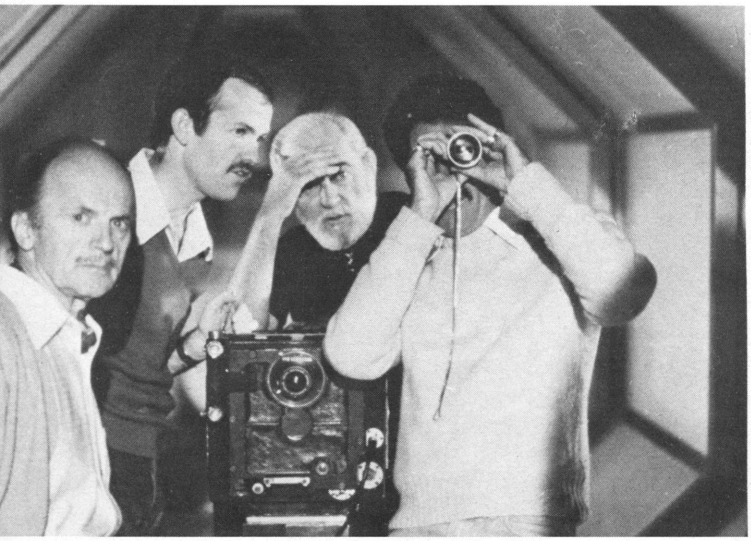
Perhaps in 100 years or less, when we are able to send something out into deep space to get near one, we might find that our concept of the Black Hole is quite authentic—if whatever is sent out there isn't destroyed before it is able to send back any pictures of it. But since no one has been close to a Black Hole yet, we had a lot of freedom in putting together the elements. It's a void in space, but when you get close to it, what does it look like? It must look like something. It can't be just a blank. If it were, it wouldn't be very interesting on film, so we have taken the liberty of creating a Black Hole to suit our needs and the needs of the film. I believe we've made it exciting and that's our first obligation—cinematically to intrigue the audience.

During the past two years there have been thousands of problems. On a picture like this you shoot out there one day, then you look at it the next day, then you reshoot it. That's the way it is with any kind of effects work. It seems as though we all learn as we go. But in our mechanical effects, in our miniatures, even in a great deal of our live action, we would have to redo. We were constantly experimenting. We were using the techniques of explosives, the techniques of robots, the techniques of wire work—you name it. I'm not saying that we shot the picture twice. We didn't shoot everything over, but a considerable amount of it had

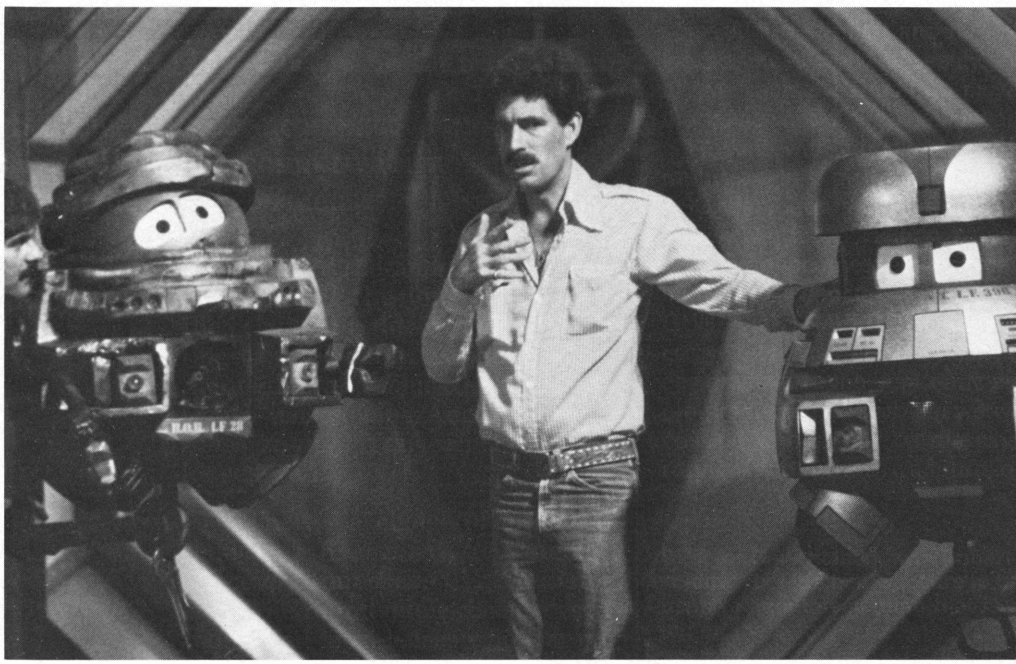


Fresh from having directed ABC-TV's WASHINGTON BEHIND CLOSED DOORS, Gary Nelson finds himself directing the likes of Vincent the Robot in THE BLACK HOLE. (BELOW) Director of Photography Frank Phillips, ASC, Nelson and Ernest Borgnine (who plays the role of Harry Booth) on the set. Nelson had the benefit of 10 months of pre-production, working closely with all of the people responsible for creating the effects.





(LEFT) Peter Ellenshaw, Harrison Ellenshaw, Frank Phillips and Gary Nelson line up a matte shot with the VistaVision camera. (RIGHT) Nelson directs Yvette Mimieux and Joe Bottoms in a scene. (BELOW RIGHT) Nelson setting up a robot shot. Besides having to extract performances from the live actors, he had to cope with an array of exotic mechanical props and stay on top of a myriad of extremely intricate special effects. He stayed with the project all the way through its final scoring and mixing phases.



to be redone to make it spectacular on the screen. We didn't just let something go through for the sake of saying: "That's done. Now let's go on to something else, even though it may not be quite perfect." We've been very meticulous on the whole picture. We've also broken in a lot of new equipment—like the ACES camera system that was designed for us.

As I said before, there have been thousands of problems, but we've managed to overcome all of them. We've managed to stay in-house with everything. We've not had to go outside for anything at all—any optical work, any mix work. It's all been done at the Disney Studios. This has been possible because Walt Disney was kind of a pioneer in effects work and the experts he chose stayed at the studio. We just gathered them together. Fortunately some of the best in Hollywood were right on the Disney lot.

In a picture like THE BLACK HOLE that relies so heavily on big special effects, you have to be careful that the effects don't run away with the film, so to speak, and become more important than the characters. The effects we have achieved will enhance the picture greatly, but it's not a picture about special effects. We have a story; we have people; we are in deep space; we have a Black Hole; we have machines—and it has been my job to make all of those elements pull together cohesively in a story-telling manner.

I worked very closely with all of the people responsible for creating the effects for ten months before we started shooting. That included our Production Designer, Peter Ellenshaw, Danny Lee (head of the Mechanical Special Effects department), Harrison Ellenshaw (who did all of our matte work) and Art Cruickshank (in charge of filming the miniatures). We had an opportunity to take ideas and designs and work with them on a broad scale for about ten months. During that time we were able to discuss what the look of the picture was to be, what the effects should say and do, and to storyboard the entire film.

Following that there were months of tests that we made with the new camera system (ACES), with the hardware, with effects, with mattes—tests that proved invaluable in creating the look of the entire picture. Whereas I had been unable to do any preparation prior to coming onto the project, I had ten months of working closely with all of the people who were going to be involved. It was the greatest training in the world for everyone because we were able to learn from our mistakes during the training period and then start absolutely from scratch.

The effects in the picture evolved from everyone's input. The concepts of deep space, where the action takes place, and the Black Hole itself come from the imagination. They are no one person's specific ideas. They are a combination of ideas offered by a number of people involved in the creative process. If one person were to say, "This is the way I want it to look," it might be almost a physical impossibility to get the effect, but with all of the heads of departments each saying, "I can do this," we were able to come up with very satisfactory and spectacular effects.

Yet, we were still experimenting all the

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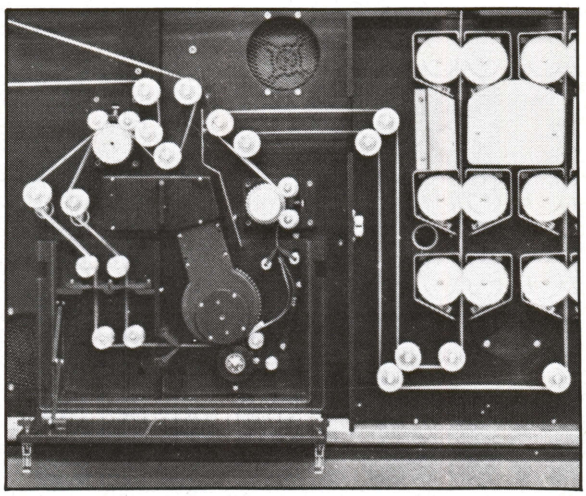

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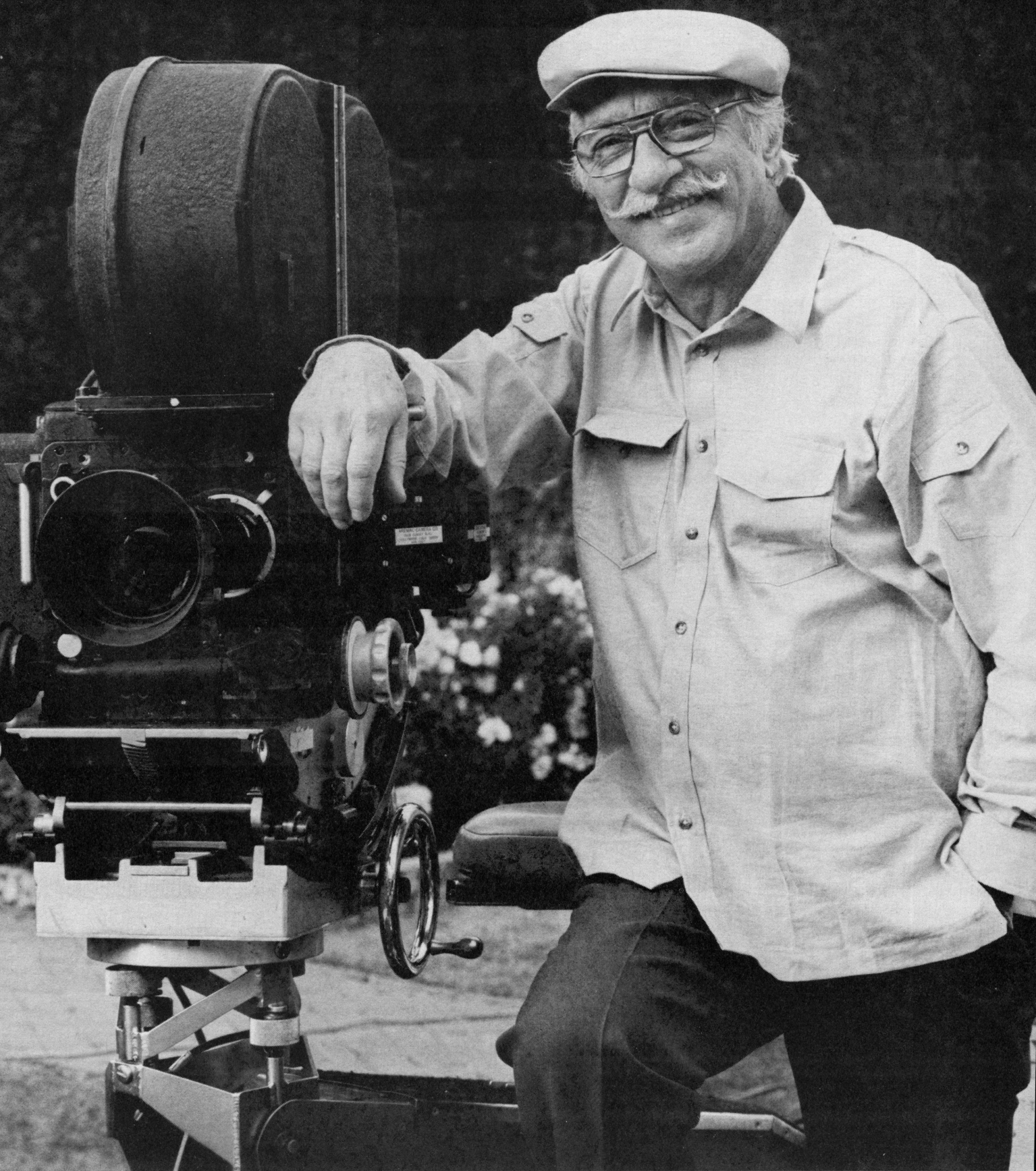


PHOTOGRAPHING MINIATURES ON A MASSIVE SCALE

Filming to scale endless reaches of the Universe, gigantic spaceships and a vast and strange cosmic phenomenon that no one has ever seen demanded infinite patience and the expertise of an entire career

By ART CRUICKSHANK, ASC
Director of Miniature Photography

THE BLACK HOLE has been the most difficult special effects film that I've ever worked on. In FANTASTIC VOYAGE we had more than 400 special effects in the final cut, including mattes. In THE BLACK HOLE there are at least 550, a tremendous number.

At the very beginning we had extensive storyboard meetings concerning what visual concepts would be involved in the making of the picture. We had many discussions and I drew the assignment of miniature photography. I worked in close coordination with Peter Ellenshaw (Production Designer), Eustace Lycett (Composite Optical Photography) and Frank Phillips, ASC (Director of Photography).

Frank and I would try to blend our efforts so that what he shot in the First Unit would match with what I was about to shoot in miniature photography. However, sometimes the cart was before the horse, because I would shoot something and Frank would have to match to it.

On every picture I had been involved with up until THE BLACK HOLE, the practice was always to complete the principal photography first. The film was given a rough cut and then we decided what we were going to need in the way of miniature photography to augment what had been shot by the First Unit. I prefer to work that way, because when you are shooting live action and miniatures concurrently, there has to be a constant flow of information back and forth. Fortunately, in this case, such an interplay was possible. Frank has such a great talent and is so cooperative that we were able to exchange viewpoints and information that kept us rowing the same boat, so to speak.

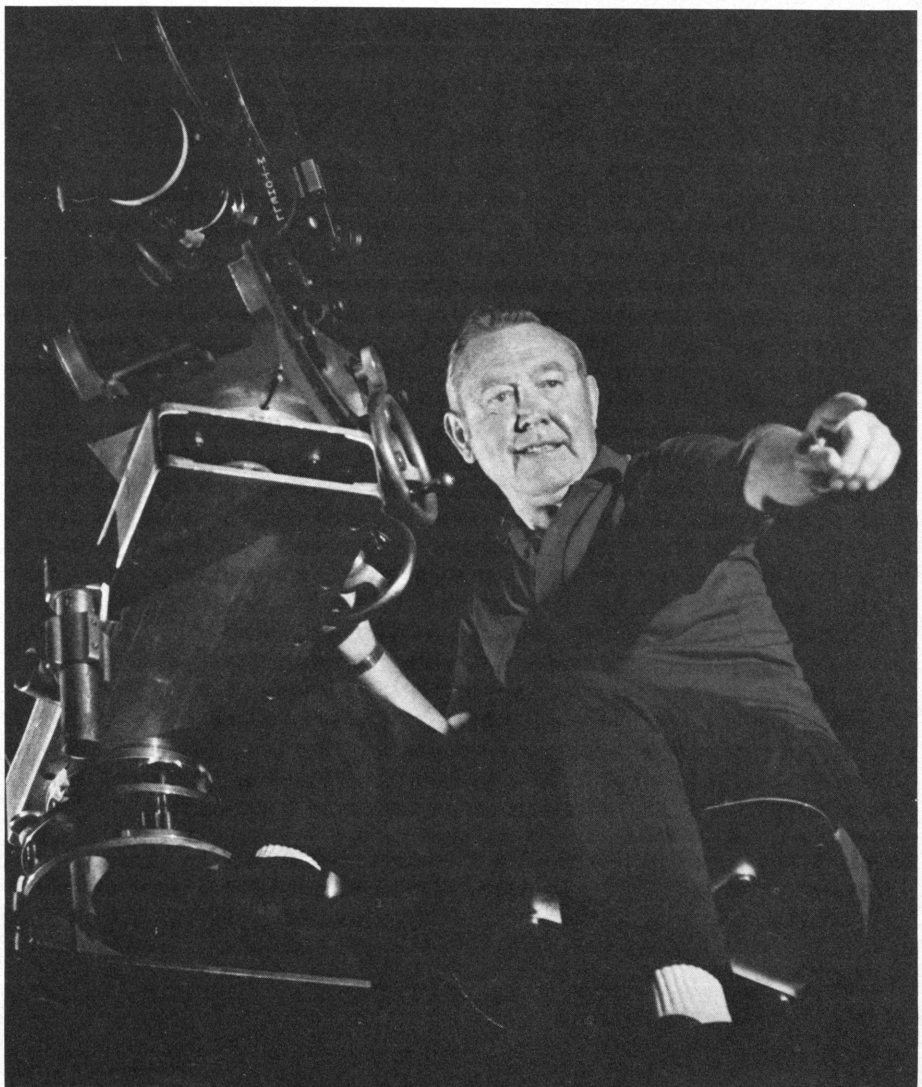
In the case of a sequence in which people are shown working on the exterior of the spaceship Cygnus and you see the principals in a red mist, Frank Phillips did his work first and I had to match what he did with my long shots of the Cygnus. We had smoke effects and red effects that matched his, using the same gels he had used when he shot the live action. In a reverse situation, I shot the landing of the Palamino spaceship first and I shot the landing of the probe ship before Frank got to the live action portion of it, so he matched what I had done, using the same gels and techniques I had used to shoot the miniature. Of course, he was shooting mainly closeups and I was making long shots. Because of the wonderful rapport that existed between Frank and myself during the making of the picture we did accomplish the objective of having our separate efforts blend smoothly into one, and that was the most difficult challenge of all.

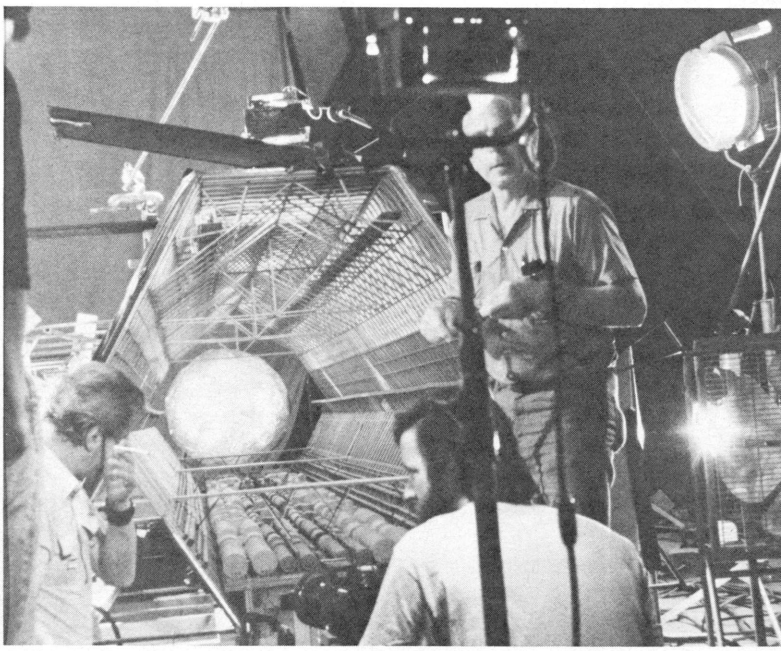
It became my assignment to plan the moves of the miniatures and program them, either through the new ACES (Automatic Camera Effects System) or to shoot them live, as I had shot miniatures in the past. It was Peter Ellenshaw's assignment, as Production Designer, to determine how these shots should look. He and I worked closely together on lighting, because he had definite ideas about how the miniature of the U.S.S. Cygnus should read against the sky, and I cooperated with him to the fullest extent to get the look that he was after.

When we all sat down to design ACES—Don Iwerks, representing the machine shop; Dave English and Dave Snyder, representing the WED people; Eustace Lycett and myself, representing the studio; and Peter Ellenshaw, whose particular needs regarding THE BLACK HOLE were of prime consideration—we went through a period of many meetings and discussions with other people who volunteered to manufacture systems for us. In the end, we decided that, since the equipment would be operated by people trained at the Walt Disney Studios, we would pool all of our expertise and design the thing ourselves, based on multi-plane technology. That was the birth of ACES.

Before building our equipment, we had examined the other systems that were available, but I'm convinced that the system that we arrived at is the most advanced that there is in Hollywood. That is not to say that the state of the art is not constantly improving or that we won't be making changes, but its accuracy and repeatability are extraordinary. It is unique, also, in that it has the capability of shooting in either the VistaVision or 4-perf pulldown formats. It can shoot, as any production camera can shoot, with

Director of Miniature Photography Art Cruickshank, ASC, has worked at Walt Disney Studios for 32 years (interrupted by seven years at 20th Century-Fox). He characterizes THE BLACK HOLE as having more special effects than any picture he has worked on. It is the miniatures, tied in with huge "live" sets, that lend the film its vast scope.





(LEFT) A miniature of the main corridor of the spaceship *U.S.S. Cygnus* is just big enough for a technician on all fours to crawl through. (RIGHT) Set-up for filming a meteorite, as it comes roaring down the main corridor of the Cygnus. Several scales of miniatures, ranging from 1/4th-inch down to 1/16th-inch, were used in the filming, depending upon the effects required. Models to as large a scale as possible were preferred, because they minimized the depth-of-field problem.

either the anamorphic system or spherical lens system.

Everything the multi-plane crane will do ACES will do, but on a larger scale and with more axes of movement. The multi-plane camera has a vertical move, an East/West, a North/South and a rotation—basically four axes (although there are actually more variations than that, because there are so many levels in a multi-plane). With the ACES equipment we have 18 available axes. The camera has seven axes at its disposal and the model stand has four, and we still have three axes available to us to operate equipment mechanically that is not part of ACES. In other words, we've operated a rear projector through one of the axes, we've rotated a star pattern through another, and those things turned out to be very handy. In a few cases, however, we did have all 18 axes booming at the same time.

The term "multi-plane" in this context is not to be confused with cartoon multiplane. The multi-plane capability, for example, enabled us, at times, to take the camera off of ACES, put it on a fixed camera stand, and then use the ACES camera stand to hang a 16th-scale miniature.

We designed the track so that if we ever want to use rear-projection on a massive scale, we can put the projector outside the stage door, tarp over the area, and have rear projection. It is angled so that the center line of the stage goes right out the door. Also, we brought it right to the edge of the tank, because eventually we might be shooting miniatures in water. The tank is eight feet deep and was originally designed for 20,000 LEAGUES UNDER THE SEA. In shooting THE BLACK HOLE it was very useful to us, because we could put our star backing in the tank, which gave us unrestricted lens angles. If we hadn't done that, we would have photographed the track of ACES, but by moving up to the edge of the tank we were able to shoot with wide-angle lenses without photographing the floor.

Without the availability of the ACES equipment, we wouldn't have been able to accomplish what we did accomplish for THE BLACK HOLE. We were able to create intricate effects better and easier with this equipment. Had we resorted to our old equipment, we would never have been able to complete the picture in the time alloted—nor would we have had the range or size capabilities. ACES has a 66-foot precision track. We used, previous to this, equipment with a 30-foot track, whose precision was in doubt at all times. It was based on a lathe bed and a moving platform on a non-position rail.

The main miniature used in THE BLACK HOLE was, of course, the spaceship U.S.S. Cygnus. Built to 1/16th scale, it was about 13 feet long. We worked with miniatures of various scales. In one case we had a 1/16th-inch scale model of the Cygnus (one inch being equal to 16 feet), and people were supposed to be riding in an air tube on the outside of the Cygnus. In order to get a camera lens through the structure of the air tube, we couldn't do it at 1/16th scale, so we increased the scale of the air tube from 1/16th to 1/2 inch. This meant that as I programmed the automated camera system relative to a 1/16th-inch scale, I had to increase the increment eight times so that it would look like they were going through the air tube on the spaceship.

For the sequence in which the Cygnus finally begins to break up and go down the Black Hole, we built sections of the craft to 1/4th-inch scale. The Palamino, which was the smaller spacecraft in which the crew arrived to explore the Cygnus, was built to 1/4th-inch scale, which made it about 18 inches high and 12 inches wide. Then we had a 1/4th-inch scale probe ship, which was a craft sent out by the Cygnus to do extraterrestrial exploration and report back. The probe ship was about 14 inches long. That covers all the miniatures that we used, with the exception of miniature robots. We shot some miniature robots in front of the blue screen and they were 1/4th-inch scale, which made them about six inches in diameter. We looped-the-loop and did barrel rolls with them and then shot miniature backgrounds to composite with them.

Our principal miniature of the Cygnus was lit entirely from within. This presented a problem, because the scale on which we were operating (1/16th-inch) was so small that the amount of foot-candles that could be put out was also very small. That meant that we had to give a long exposure to each frame when we shot the model.

The Cygnus miniature evolved according to the usual flow of such projects at Disney Studios. The original design came from Peter Ellenshaw. It was turned over to the Art Department, where a plan

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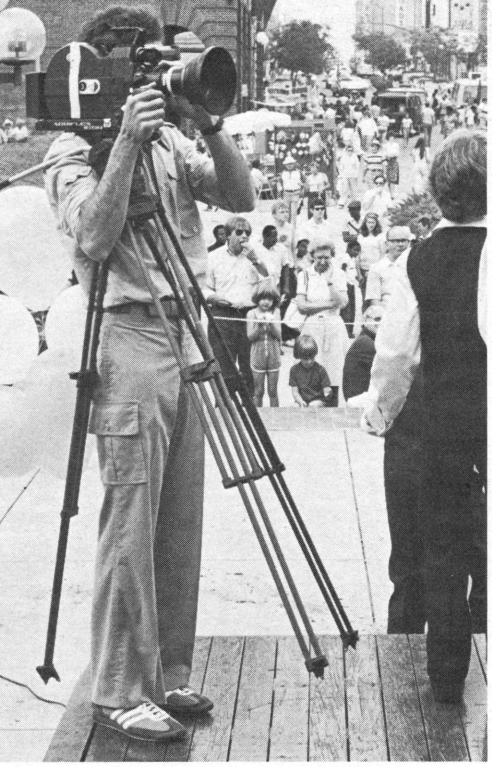
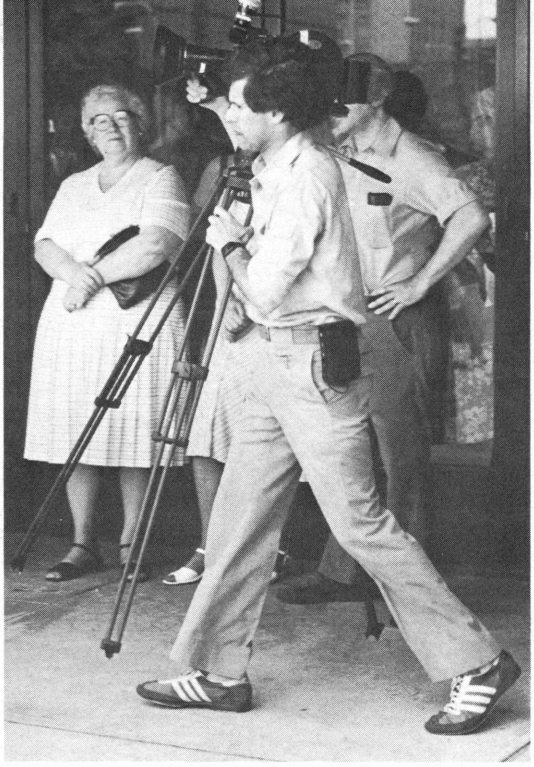



Shooting a documentary: quick moves. Camera rests comfortably on Mr. Fauer's shoulder as he hand-holds with tripod attached.

Hand-holding with the tripod on the camera! Jon Fauer talks about working with a Sachtler:

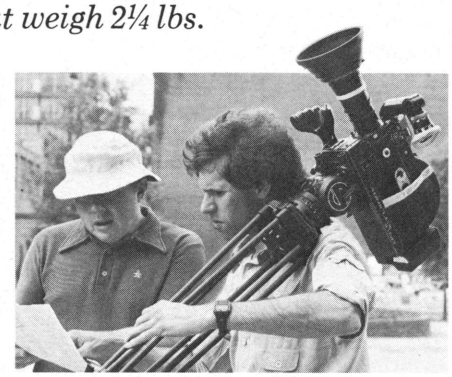
The effect on documentary style of a 6¾ lb. fluid head and carbon-fiber 58 inch legs that weigh 2¼ lbs.

"When the action isn't going to repeat and it's happening fast, you often have to go hand-held," says documentary cameraman Jon Fauer.

"But you give up a lot, of course. No steady long-lens closeups. No throwing the background out. Even staying wide, the image isn't really rock steady on a big screen. All these things you sacrifice for speed."

"I bought the Sachtler because of its incredible light weight with the carbon-fiber legs. After I began using it, I found I could make quick moves to a new angle carrying tripod and camera together. The Sachtler was the first tripod that didn't slow me down."

"The quick-release plate lets me go hand-held fast—and with the ARRI SR on my shoulder, the plate doesn't dig into me. I find I can put the camera back *onto* the Sachtler faster than I could with any other tripod."



"We spend half the time carrying the equipment around," says Jon Fauer. "Weight is important."

"Using my SR on other fluid heads, I was always fighting the counterbalance spring. Too much or too little. The Sachtler's adjustable spring gives me perfect neutral balance—with my 400mm *and* my Zeiss Superspeeds."

"The SR's tripod socket is fairly far forward on the base, and the Sachtler's quick-release plate is small. That's why it doesn't dig into my shoulder," says Mr. Fauer.

"The head is small, too. And this led to something I wouldn't have believed. In the heat of the moment, I found myself needing a hand-held shot *fast*. So I began hand-holding—*with the tripod still attached*! I forgot it was on there."

Who took the photos on this page—and why is that significant?

On this job, there was a two-man crew: Jon Fauer, cameraman, and his assistant, Jeff Laszlo. Usually, the assistant has his hands full carrying the tripod around two steps behind the cameraman. As you can see, Mr. Fauer carried camera and tripod himself. The pictures were taken by Mr. Laszlo.

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Listed alphabetically below are some ARRI dealers in whose showrooms you can now inspect Sachtler tripods.

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WHAT'S NEW
Continued from Page 8

or podium, the Model CV 150 works with all tape gauges and speeds and features two adjustable scanning rates with sensitivity control. It consists of a display unit, low noise preamplifier and power supply (prescan head not included). Introductory price: $695. Custom versions are available.

For further information, write to Ron Alexander, CUE VUE, 16 Homer Lane, Menlo Park, Ca. 94025 or call 415-854-2236.

●

LMC INTRODUCES AUTO-DEMAND LOOP CABINET

A high-speed Auto-Demand Loop Cabinet, for use in printing multiple copies with a continuous printer, has been introduced by Lab Methods Corporation, Van Nuys, California. The system will operate automatically at speeds in excess of 1500 ft/min.

The LMC Auto-Demand Loop System stores in transit, and returns to the printer, motion picture, micrographic and other masters to eliminate rewinding and rethreading. The system is comprised of a modular cabinet which houses four banks of rollers mounted on two carriages; electronic controls and power supply; and remote control mounted on the printer. Each top roller shaft is driven by its own motor whose speed is automatically adjusted by a sensor. Low-mass polypropylene rollers, combined with low-inertia PM torque motors, immediately respond to printer starts and stops. An electronic control system sets loops automatically.

The basic module accommodates up to 500 ft. of 16mm or 35mm film. If only 16mm film is to be used, 16mm rollers can be fitted for a capacity of 1200 ft. By ordering both 16mm and 35mm shafts, the cabinet can be used to full capacity by changeover which takes only a few minutes. Additional modules can be added side-by-side or the basic module can be extended vertically for increased capacity.

The LMC Loop Cabinet measures 35 x 33 x 79 inches and weighs 275 lbs. Power requirements are 115v, 60Hz, 5A max.

The pressurized and safelighted modular cabinet has an extruded aluminum framework with transparent panels. Access to the interior is from both sides via full-length folding doors that occupy only one foot of space when open. Right- or left-hand models are available. Compatible pairs can be furnished for picture and sound track.

Suggested list price for the 500 ft. 35mm basic loop cabinet system is $5,995.00.

LMC will furnish custom cabinets to meet special size, shape or capacity requirements.

For more information contact Lab Methods Corporation, 7645 Densmore Avenue, Van Nuys, CA 91406; (213) 782-0735.

●

FREE LMC PROCESSOR DRIVE COMPONENT SPECIFICATION AND PRICE LIST

A new drive component specification and price list for 16mm and 35mm continuous photographic processing machines has been issued by Lab Methods Corporation (LMC). The new publication in- of 16mm and 35mm paper and film rollers; of 16- and 35mm pacer and film rollers; roller spacers and spring inserts; glass and stainless steel ball bearings; drive discs; and soft-touch tires.

For your free copy contact Lab Methods Corporation, 7645 Densmore Avenue, Van Nuys, CA 91406, (213) 782-0735.

●

LIGHTWEIGHT SNORKEL LENS

A new and revolutionary lightweight snorkel lens has been designed by Stephen Hajnal.

This is the first snorkel lens which has been miniaturized so that it may be used with hand-held cameras. Only 12 inches long and 40 ounces in weight, it can be mounted in any motion picture camera (35mm, 16mm, and Super-8) including Mitchell, Arriflex, Panavision, Eclair, etc. The Hajnal Snorkel will also mount on all models of television cameras, both studio and portable types. It may also be used with 35mm still cameras. Mounts and adapters are available for all these.

The lens possesses excellent optical quality. The types of photography available with the Hajnal Snorkel are limited only by one's imagination. Intricate table-top TV commercials have already been produced with this equipment mounted on RCA TK76 cameras and the 35mm Arriflex BL. The Snorkel accepts any prime lens in Arriflex mount from a focal length of 5.7mm on up and including all zoom lenses.

The Hajnal Snorkel is exclusively distributed worldwide by F&B/Ceco and may be seen at both offices—at 315 West 43rd Street, New York and 7051 Santa Monica Blvd., Hollywood, California. First introduced at the NAB in Dallas last March, the Snorkel is already being sold by a number of professional dealers in the United States, England, Hong Kong, Japan and in South America. ■

SCREEN MAGIC FROM "SNOW WHITE" TO "THE BLACK HOLE"

After more than four decades of creating spectacular illusions, this consummate artist/technician outdoes himself on Disney's latest film

Mild-mannered, soft-spoken Eustace Lycett heads Walt Disney Studio's Special Photographic Effects Department. His work in BEDKNOBS AND BROOMSTICKS, a musical fantasy co-starring Angela Lansbury and David Tomlinson which skillfully combines animation and live-action, earned him his second Academy Award. He had previously won an Oscar for Special Visual Effects for MARY POPPINS in 1965.

Born December 21, 1914, in Staffordshire, England, Lycett traveled widely as a child with his father, an English mining engineer. His family moved permanently to the United States in 1933, just in time for him to enroll as a freshman at the California Institute of Technology. Upon graduation in 1937 with a B.S. in mechanical engineering, he joined the Disney organization in the engineering department.

Lycett's first project was to assist with the design and construction of the first multi-plane camera, which was immediately put into service on a Silly Symphony short, THE OLD MILL, and also on the first feature-length animated cartoon, SNOW WHITE AND THE SEVEN DWARFS. Both were honored with Academy Awards, as was the creation of the multi-plane camera itself.

Transferring to the Multi-plane Scene Planning Department, he worked with artists and layout men to design the scenes for such classics as BAMBI, PINOCCHIO and FANTASIA. He continued in scene planning during the war years, working on training films which Disney produced for the armed forces.

After the war, Lycett became assistant to Ub Iwerks, a technical genius who had been with Walt Disney in the early days and had recently returned to the studio to supervise optical printing on motion pictures combining live-action with animation. Together they worked on films like THE THREE CABALLEROS, SONG OF THE SOUTH and SO DEAR TO MY HEART.

When Disneyland started to become a reality, Walt Disney asked Lycett to help develop Circle-Vision, a process of film projection on a 360-degree screen, and to create such in-park attractions as the Moon Ride.

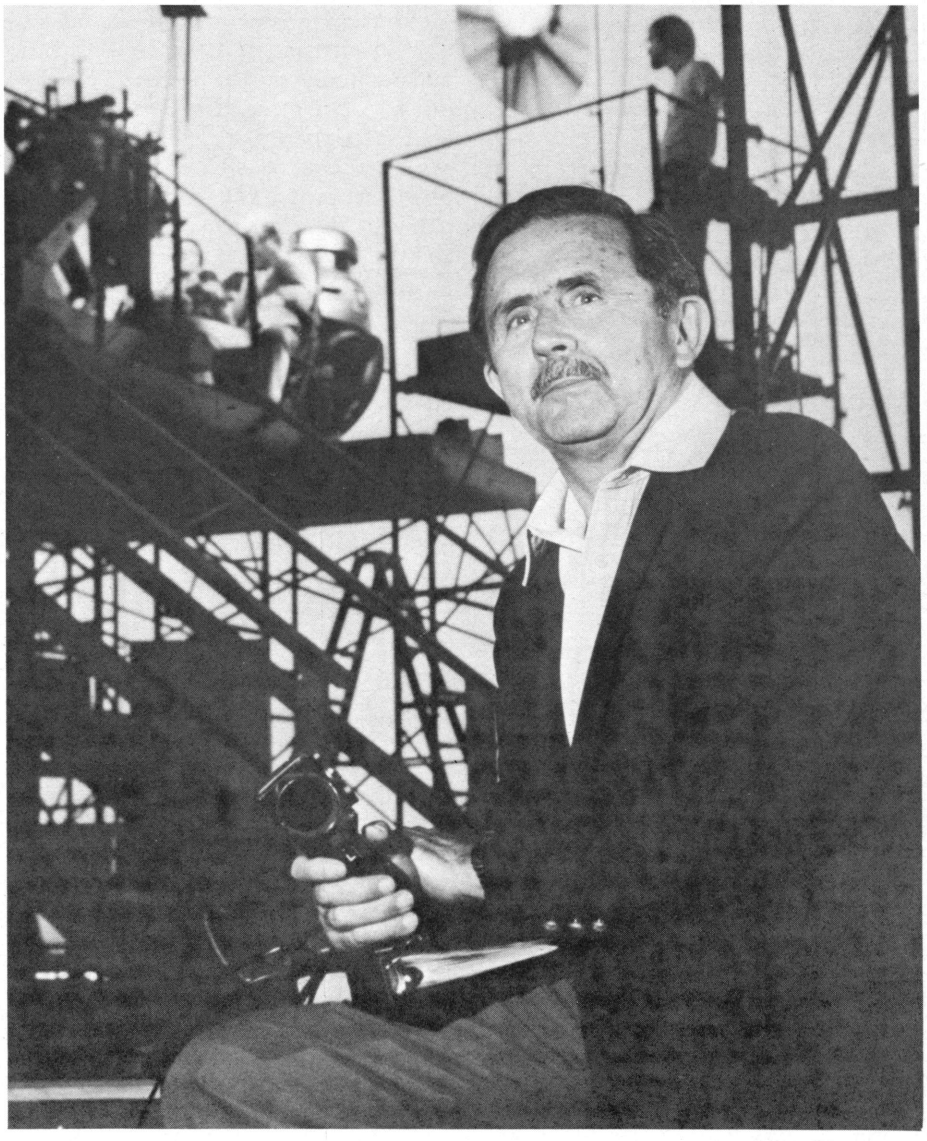
He was recalled to film production in 1953 for 20,000 LEAGUES UNDER THE SEA, and five years later was made head of the Special Photographic Effects Department. Since then he has worked on all of the Disney films, including such box office smashes as THE SHAGGY DOG, THE ABSENT-MINDED PROFESSOR, THE PARENT TRAP, SWISS FAMILY ROBINSON, THE GNOME-MOBILE, BLACKBEARD'S GHOST, THE LOVE BUG and THE COMPUTER WORE TENNIS SHOES.

For BEDKNOBS AND BROOMSTICKS, he admits, "We relied on the knowledge and experience we'd gained on MARY POPPINS. But this one had considerably more complicated relationships between the cartoon and live-action characters. There was a lot of flying involved with a huge brass bed, and then there was Angela Lansbury soaring around on a broom. Some of the illusions were difficult to create."

Another film, NOW YOU SEE HIM, NOW YOU DON'T, a comedy spoof on invisibility set for July release, also posed problems.

"The picture was particularly tough because we had many different kinds of things disappearing all the time and had a lot of floating props," Lycett says. "Shoes dance by themselves and kick people. Fingers disappear on a guy's hand. There's even a sequence with a guy who's only half there, where we had to resort to a split screen process. We used everything in the book for that show."

Starting at Walt Disney Productions in 1937 as a mechanical engineer, Eustace Lycett went on to become head of Special Photographic Effects for the studio, winning a well-deserved Academy Award for MARY POPPINS. After 42 years at Disney's, he will retire on December 28, 1979. On THE BLACK HOLE he is credited for Composite Optical Photography.



QUESTION: How did your film career begin?

LYCETT: I started here at Disney as an engineer in 1937. I was fresh out of Cal Tech with an engineering degree and I was hired to help design the multi-plane camera cranes and to redo all the cartoon cameras. That was just about the time SNOW WHITE was in production.

QUESTION: When did you begin working extensively in photography?

LYCETT: About the time Disney started branching out into live action/cartoon combinations like SALUDOS AMIGOS and SONG OF THE SOUTH—in 1945. Ub Iwerks returned to the studio and I worked with him to set up the optical printing department. We actually designed and built our optical printer, which was a technological breakthrough because it was the first two-headed printer in the industry. Then Walt got the idea for Disneyland and I went to the machine shop where we worked out the first Circle Vision camera.

QUESTION: What was the basic design of the first Circle Vision camera?

LYCETT: Eleven 16mm cameras all synchronized on a plate. There were a few bugs in that first system, and it has since been improved. The 35mm Circle Vision system used today at Disneyland has been reduced to nine cameras.

QUESTION: Was that the extent of your Disneyland tour of duty?

LYCETT: Yes, I went back to Ub Iwerks in the optical printing department, which is where I learned the basics of photographic effects, really got my feet wet in it. The department expanded to a dozen people as we took on more live action, and when Ub left to become head of research at the studio in 1958, I took over.

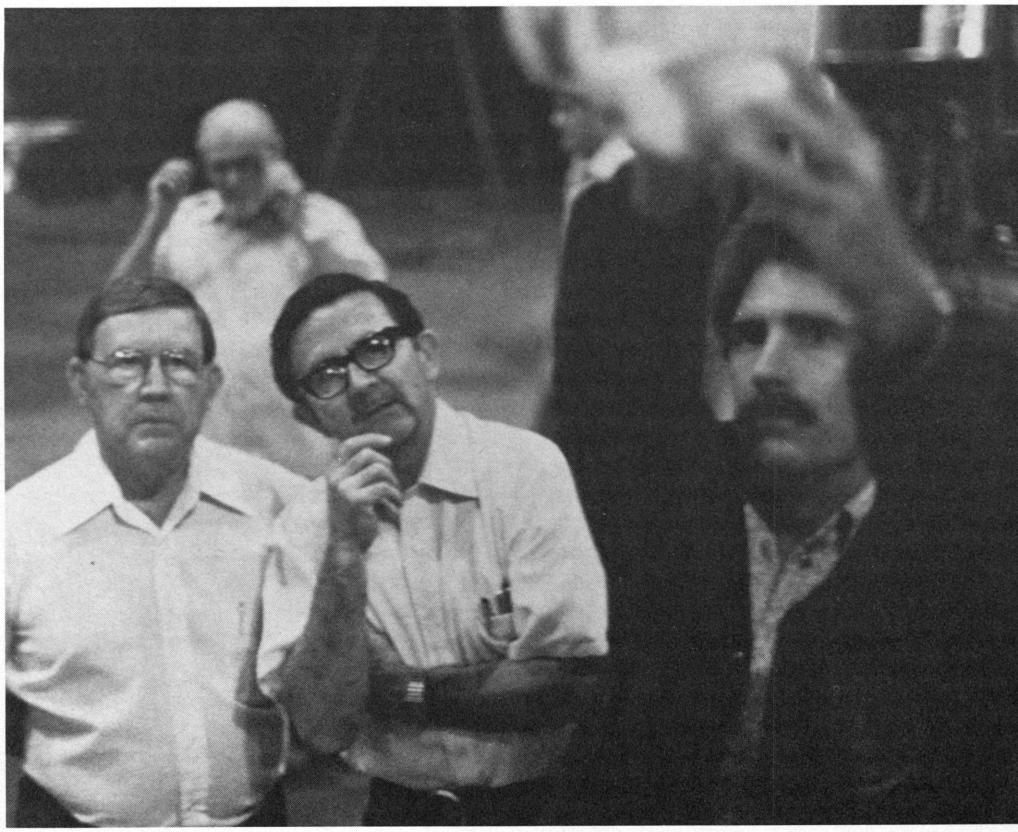
QUESTION: What was the first feature you worked on as head of the department?

LYCETT: DARBY O'GILL AND THE LITTLE PEOPLE.

QUESTION: You walked into a tough one.

LYCETT: Yeah. I had worked with Peter Ellenshaw on 20,000 LEAGUES UNDER THE SEA and I worked with him again on DARBY O'GILL. It was an unusual picture because we did almost all the effects right in the camera.

Continued on Page 78



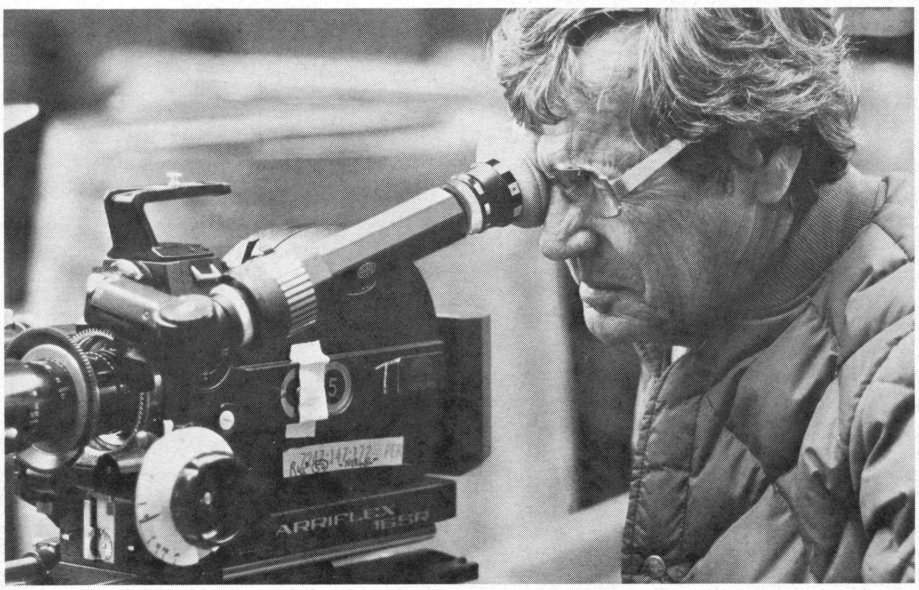
Mechanical Special Effects wizard Danny Lee and Eustace Lycett listen aptly as Director Gary Nelson describes an effect he wants. (BELOW) Yvette Mimieux and Robert Forster, playing astronauts in a "weightless" scene for THE BLACK HOLE "float" in front of a blue screen. The wires supporting them have been carefully painted out so that they will not be detected on the screen.

What's this—a 16mm camera on a geared head, on a crab dolly, on *tracks*? "You still have to do the job, whatever size film you use," says Operator Tony Brooke. "Looking through the SR's finder, you can't tell the difference. It's a production camera."

Shooting a two-hour CBS Special in 16mm:

"We shot the whole picture as though it were 35mm," says Jack Priestley.

Director Ralph Nelson with Jack Priestley. "When you see this picture on the TV screen," says Mr. Priestley, "I defy you to tell whether it's 35mm or 16mm."



Jack Priestley lines up a shot with the 16SR. Note the new white follow-focus marking disc.

"After a while, you forgot whether you were shooting thirty-five or sixteen, or whatever. It was just *the camera* sitting there."

That's Director of Photography Jack Priestley, A.S.C., talking about making *You Can't Go Home Again* for CBS.

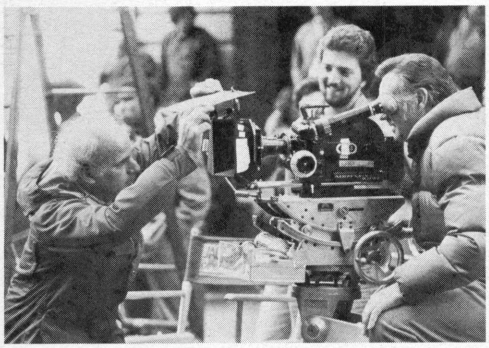
"There wasn't a hand-held scene in the whole picture," says Mr. Priestley. "And we weren't pressured for time—it was like working on a feature."

"I ran tests before we started...was glad to have the Zeiss fast lenses. All our night exteriors we shot at T1.3. And we shot most of the interiors at T2, to get maximum effect from our low-contrast filters."

Shooting from a window, Tony Brooke uses the 16SR finder on the *right* side of the camera.

"16mm isn't fully accepted yet. Partly, that's because there hasn't been a 16mm camera adequate to *handle* a feature," says Mr. Priestley.

"But this Arri SR is studio quality. For example: we shot some closeups three feet away—and, I'm telling you, you couldn't hear that camera run."



First Assistant Richard Reis positions a flag. "That camera really paid off on this job," he says. "It's a pleasure to work with."

The 16SR

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A SPECIALLY EFFECTIVE MAN

Smoke, steam, explosions, people on wires, miniatures of spaceships and robots—all in the day's work for this mechanical effects wizard

By MICHAEL BONIFER

There is a sturdiness to Danny Lee's manner that implies the nature of his job as head of Disney's special effects department. A special effects man is the fulcrum between the dreamers and the builders at a movie studio. "Give us a car that drives on water!" the dreamers demand. "Give us a robot that floats on air!" Danny Lee and his peers, people of equal parts imagination and practicality, more often than not can deliver what is asked.

As Lee speaks from his glassed-in office on Disney's backlot, he looks out across a shop strewn with Volkswagen parts, the makings of another "Herbie" movie, which will require 20 cars rigged to perform such mechanical stunts as wheelies, blind driving and swimming. This is Danny Lee's last major chore in two frenetic years of Disney special effects films.

Most of 1978 and the first half of 1979 were taken up by THE BLACK HOLE, a $20 million production heavy on the mechanical effects. "I would say that we used just about every type of mechanical effect in THE BLACK HOLE," Lee says. "Of course there was a lot of wire work, where the actors were supposed to be floating weightless. And all of our robots floated, so they had to be on wires most of the time. Then there was the smoke, steam, miniatures, explosions—you name it, we had to do it."

Intensive work on THE BLACK HOLE continued almost uninterrupted until May of this year, when special effects staffers had to be diverted to work on THE LAST FLIGHT OF NOAH'S ARK. It was 3-month job which required four specially-refurbished B-29 bombers.

Two of the old planes, which were found at the Navy's China Lake depot in northern California, had to be reassembled in Hawaii, where much of the filming took place. And one of those had to be rigged to sail in the open sea. Then it was back to land, to more of THE BLACK HOLE and early preparations for HERBIE GOES BANANAS.

Fortunately for Lee, special effects work is in his blood. "My father, Carl Lee, was in the business as a special effects man. He worked all over Hollywood, wound up in his later years at Universal. He did all the Abbott and Costello shows. They thought the world of him. They said that after they made their first million dollars they would build him a big home on top of the hill—which they never did. And they made their million bucks."

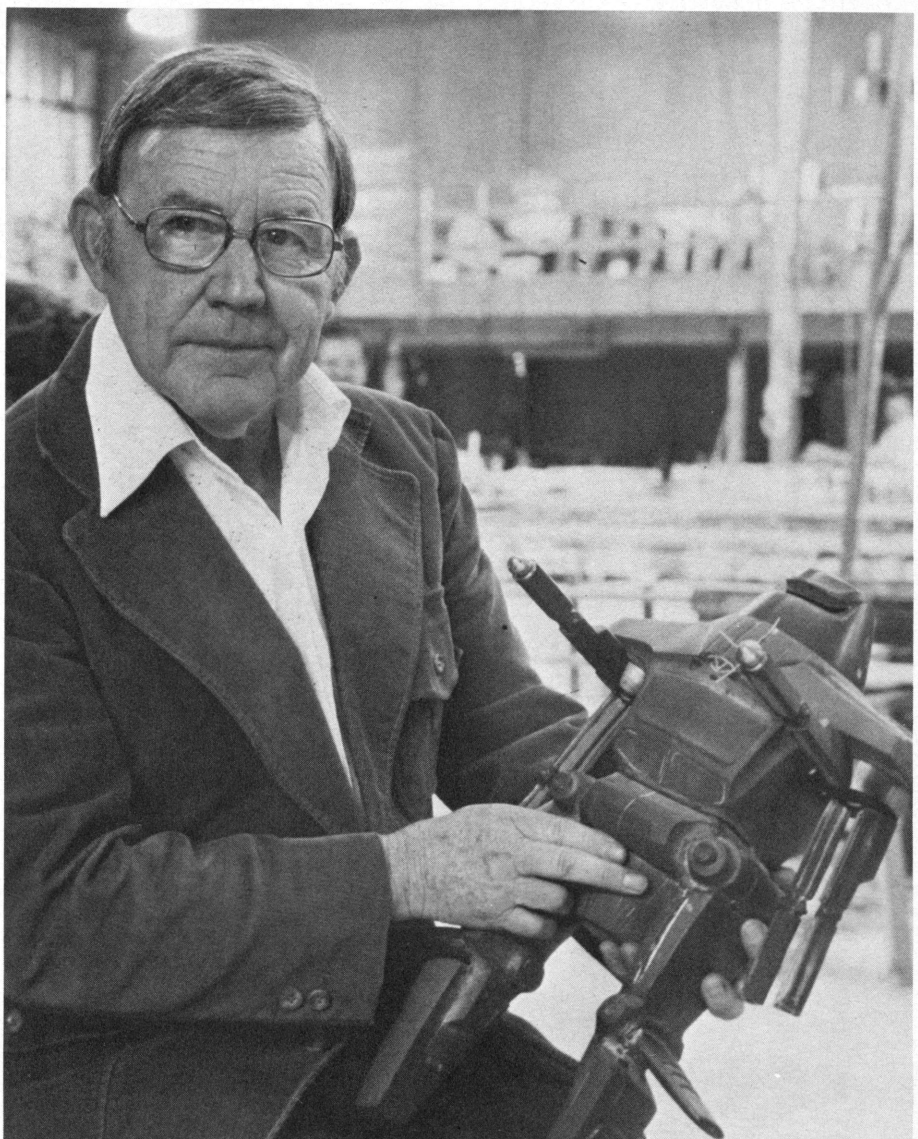
Lee's career began in 1946, when a job promised him by Lockheed Aircraft failed to materialize. "I told them to put it in their file," he recalls, "and I got a union permit to work in Hollywood." From that time until Disney filmed THE LOVE BUG in 1969, Lee worked as an independent. His skill was in demand, and though he worked frequently for Disney, he just as often was trotting the globe working on such pictures as IT'S A MAD MAD MAD MAD WORLD for United Artists and THE GREAT RACE for Warner Bros., both of which earned him Academy Award nominations. In 1972 he earned the elusive Oscar for his work on BEDKNOBS AND BROOMSTICKS.

When he came to Disney to work on THE LOVE BUG, Lee was offered and accepted a position as head of the special effects department. He succeeded Bob Mattey, who was later widely celebrated for his construction of the mechanical shark in JAWS. Lee worked with Mattey on many occasions. "He is quite a mechanic, really. He's an innovative person, and he never stops," Lee says of his predecessor.

"If you've got a job to do or a gag to rig, he'll change his mind after it's finished and tear it all apart and start all over again, resulting in never getting completely finished, even when you're before the camera. He's always changing and improving his work. He tears into something like a bulldog."

THE BLACK HOLE required all forty people on Lee's staff to tear into their work like bulldogs. The movie is a project that is coming to fruition at Christmas after three years of design and filming. "I was first called into meetings in the fall of 1977," Lee says. "We had some drawings by Bob McCall, a space artist, and Peter Ellenshaw altered the designs to his own

Danny Lee, Mechanical Effects Supervisor on THE BLACK HOLE, is shown here holding a miniature of Maximilian, a "Bad Guy" robot who holds sway aboard the derelict spacecraft Cygnus. A veteran of 34 years in the film industry, he is used to outrageous demands, but he ran the full gamut of mechanical effects in working on THE BLACK HOLE.



style. I convinced Peter that, if we were going ahead with the project, we should start building the miniatures, because I knew that was going to take a hell of a long time."

Construction of the miniatures took one year. Just to build two models of the Cygnus, which is the spacecraft central to the story in THE BLACK HOLE, took nearly six months. The Cygnus miniatures are radically different in appearance from spacecraft seen in other space films. Instead of a smooth outer shell they are built with an intricate gridwork of copper and brass.

"Building those models was extremely difficult," Lee says. "It was like building a watch. One of the problems we had was choosing materials that we could glue together, weld together, solder together—that were small enough in scale for the size of that ship. We built it in one-sixteenth-inch scale. If we had built it any larger there wouldn't have been a stage large enough to house the thing."

The Cygnus miniatures are 12½ feet long and weigh 175 pounds. Brass fittings and copper wiring surround an octagonal fiberglass core. There are other miniatures used in the film, of course, and several dozen styles and scales of robots, but these craft are the masterworks of Lee's shop. An estimate of their value in material, man-hours and originality: for shipment to New York where it was on display at The Museum of Modern Art, a model was insured for $250,000.

Was there anything Lee was asked to do for THE BLACK HOLE that proved impossible?

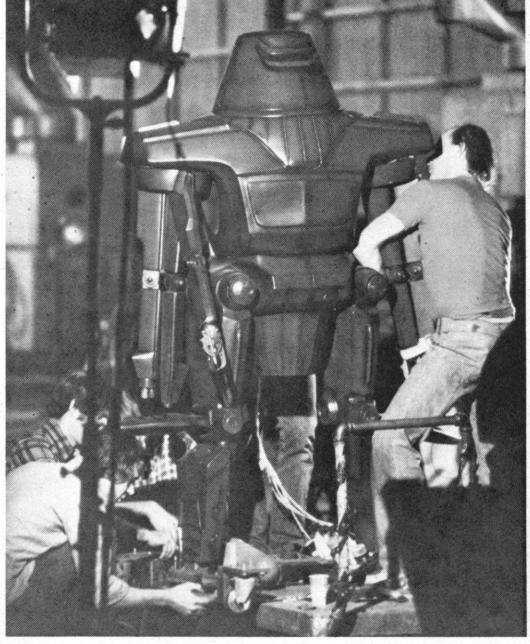
"I can't think of anything we felt we couldn't or shouldn't do. Some of the rigging was pretty *involved*. For instance, we had to blow up the main observatory of the big spaceship. I'd say we spent four weeks rigging the control paneling, getting all the materials we needed—making rubber beams that had to fall on the actors, and so on. We had everything for that scene—flash powder explosions, black powder explosions, primer cord, bullet hits, pyro fuse wires. And it's our responsibility to make sure the actors don't get hurt. One thing you have to instill in the people who work with explosives is that they have the last word on where explosions can be, and how close you can stand to them. The director can't override that decision."

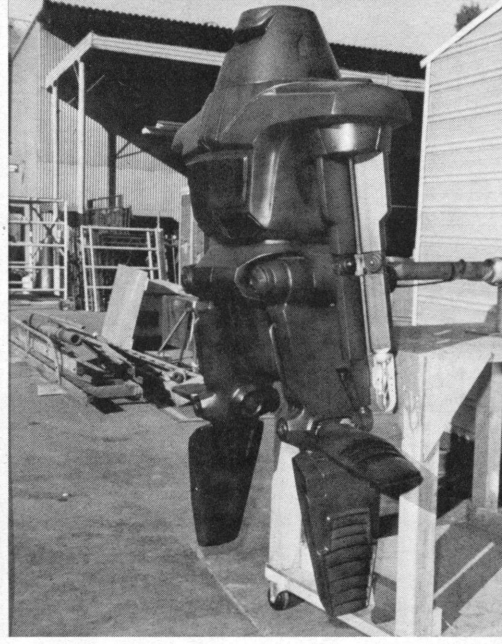
Lee's background before he became a special effects artist was in the military, and some of his staff today are young men with an armed forces background.

But Lee's talent pool has many tributaries: "We get our people from the street or from the union—if we're going to do a particular job, with cars for instance, we hire someone with mechanical skills. If he can adapt himself to welding, or woodworking, well, we may keep him on for another job requiring those skills. I have individuals here, including one woman, who walked into the studios with good backgrounds in plastics, fiberglass, woodworking, and so on. Sooner or later we ask them to do just about everything."

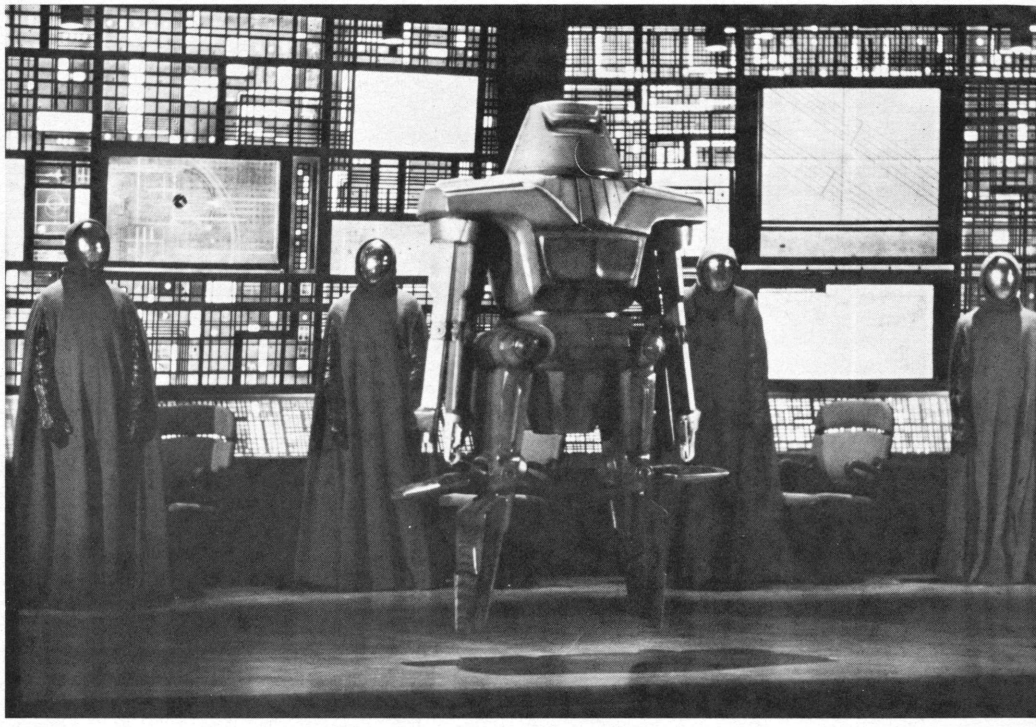
Lee feels that Disney has one of the best special effects staffs in the business, which is unintentional testimony to his own talent since most of the people working on the Volkswagens for the HERBIE film appear to be under 30, proteges of a past master.

Yet ironically, the man in the midst of the fireworks has seen the flash disappear from his job over the years. "I think at one time it was a challenge. There was a certain amount of fun in each picture, and you could enjoy the people you worked with. Today it's nothing more to me than a big business. There's a dog-eat-dog attitude that prevails, not only with producers and directors, but all the way down to the electricians and grips, to your own people. But it's been a good livelihood through the years, and I've been to a lot a places in the world that I wouldn't ordinarily have gotten to see. I've worked hard and I'm grateful for what I have." ■





(LEFT) The full-size mechanically operated Maximilian under construction at Disney Studios. (RIGHT) Between takes the robot hangs out on the backlot. (BELOW) A scene from THE BLACK HOLE in which Maximilian and a clutch of sinister cloaked humanoids await a team of deep space explorers forced to land on the Cygnus. They are the villains of the piece.



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16mm.... A Film for all Reasons

A dictionary might well describe 16 mm as the 'ubiquitous' film gauge. It is used everywhere . . . be it for TV (news, documentary, drama), for features (often blown up to 35 mm for cinema presentation), for sports (who ever saw a major sporting event without the ever present 16 mm cameras), or for a score of other reasons ranging from industrial research to industrial relations.

Name the use and assuredly 16 mm film makers from all over the world call upon us to supply equipment tailored to their particular needs. Aatons, Arriflex 16 SR's, BL's, St's and M's, Beaulieus, Bolexes, Cinema Products CP 16's, Eclair NPR's and ACL's and Photosonics 500 fps cameras are available.

We even have a Panaglide floating camera system especially modified to take an Aaton 16 mm camera.

Equally important are the lenses for 16 mm shooting. Most of our cameras are equipped with either an Angenieux 12-120 mm T2.5 or a Zeiss Vario Sonnar T3.1 but off our shelves there is what is guaranteed to be the widest range of specialist lenses for 16 mm usage available anywhere in the world.

Among the lenses our clients have at their command are such exotica as a Canon 20-500 mm T1.8/3 25:1 zoom, Cooke 9-50 mm Variokinetals, Angenieux 2½:1, 6:1, 10:1, 15:1 and 20:1 zooms, Century 3.5 mm wide angles, Zeiss wide apertures, Kilfitt Macros, Canon telephotos and all sorts of optical accessories.

And from Sammy's you get back-up. More cameras and lenses when you need them for a large shoot, replacements by the quickest possible means when trouble occurs (it can happen that even the best prepared camera is accidentally damaged on location or goes wrong electronically, mechanically or optically) and that's when our 24 hours a day, seven days a week staffing, 30 telephone lines, 2 telexes and our own freight company with an operation right there at London Airport pays off for the client.

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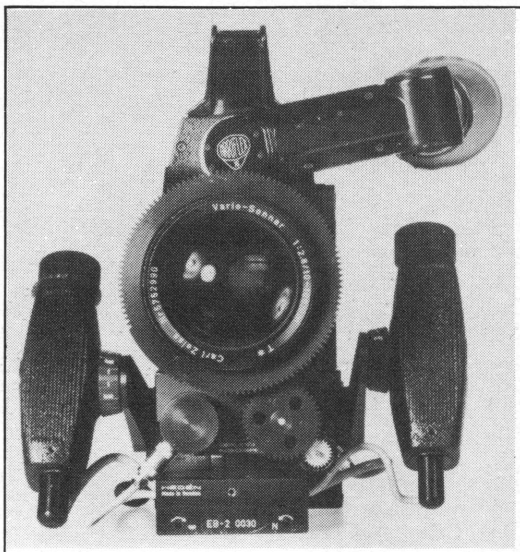
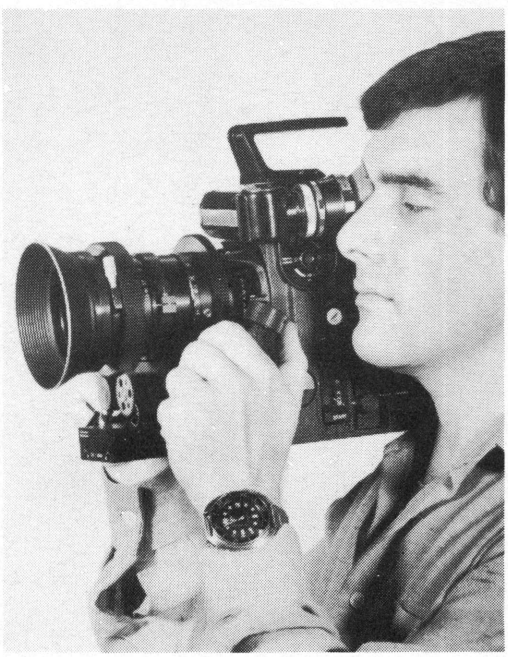


Heden 16mm Zoom Control

For those occasions when a 16 mm cameraman must do his own focus and zooming things while shooting, from Sweden we now have a Heden focus and zoom control fitted to an Arriflex 16 SR camera with the operating controls at the cameraman's thumb-tips.

The focus works on a servo system and couldn't be more positive even by holding the barrel of the lens. The zoom is by variable speed motor and couldn't be smoother.

It's the best in focus and zoom controls, and it's available from the 16 mm specialists. Of course!



THE AUTOMATIC CAMERA EFFECTS SYSTEM (ACES)

A servo-controlled camera, carriage and dolly, model stand, process projector and other ancillary devices which can be moved through a complex continuous or stop-motion shot with exact repeatability

The Automatic Camera Effects System is the Industry's first truly computer-operated camera system to be applied to film production. It consists of a servo controlled camera, carriage and dolly, model stand, process projector and other ancillary devices which can be moved through a complex continuous or stop-motion shot with exact repeatability.

Utilizing the power of a mini-computer this equipment automatically calculates the required in-between points to smoothly move throughout the TAKE passing through up to twenty key positions at specified frame numbers. This is done for all twelve axes simultaneously, while maintaining auto-follow focus or even automatically positioning the axes to follow a point of interest during the shot. A real-time video rehearsal mode allows instantaneous changes to be made and then a new rehearsal of the altered movement to be made.

The exact repeatability of this equipment has allowed original negative multiple exposure photography by the ACES camera with some shots lasting twelve to fourteen hours over several days—the film being left in the camera overnight and the equipment at turn-on the next day exactly repeating the prescribed move and auxiliary device operation. The result has been breathtaking miniature work of a quality not possible before using blue screen technique since the total shot was created within the "taking" camera with the movement of the miniatures themselves creating their own exact mattes.

ACES was conceived and designed for Art Cruickshank, Peter Ellenshaw and Eustace Lycett by Don Iwerks, Bob Otto, David Inglish, David Snyder and Steven Crane.

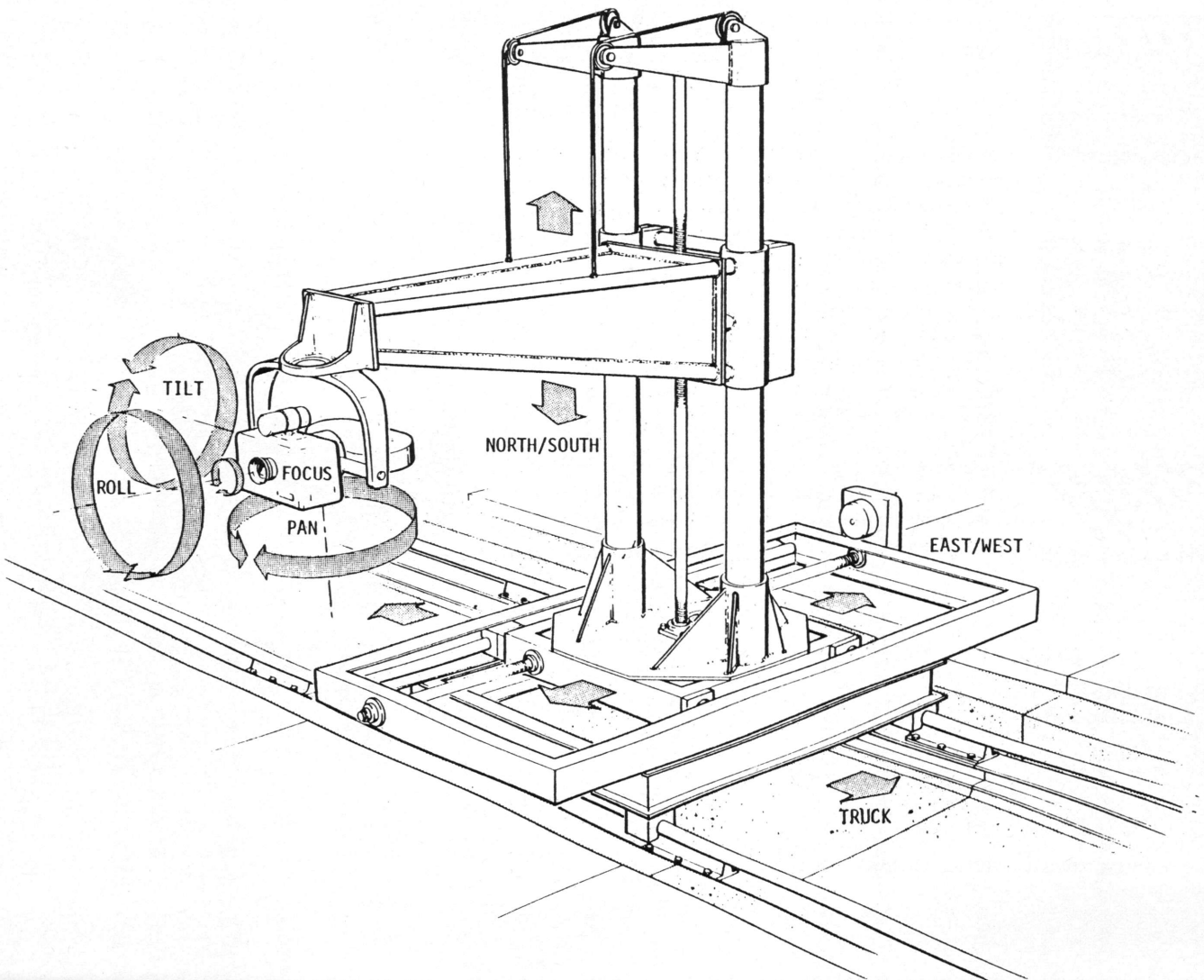
SYSTEM FEATURES

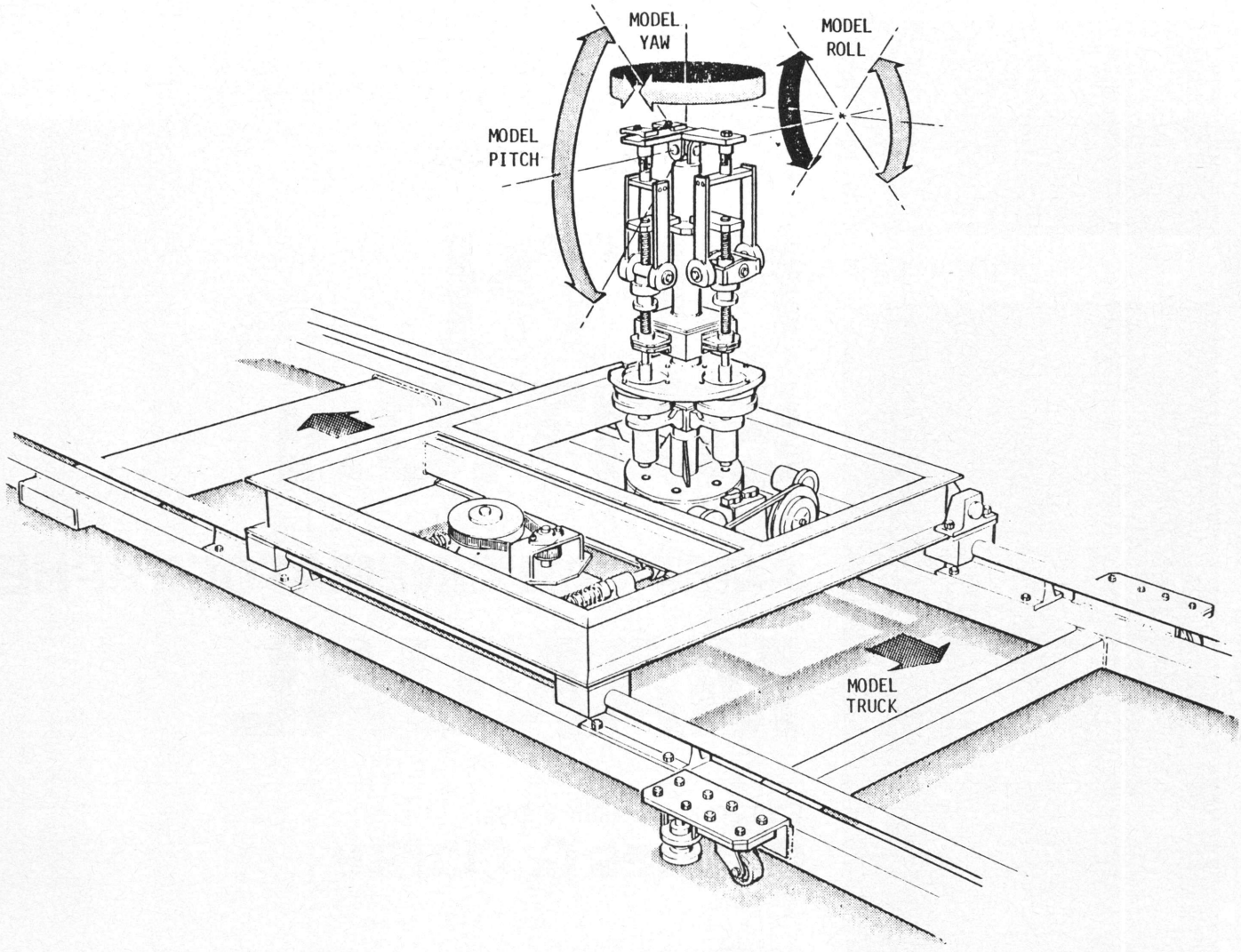
The ACES consists of specially designed Minicomputer Control System Components; Camera, TV viewing and instant replay system, Mount, and Carriage-Dolly mounted on permanent 68-foot-long track; Model Stand mounted on portable 30-foot track; Process Projector with controller; 16-foot-by-25-foot portable hi-frequency operated Blue Screen; 38-foot-by-72-foot DC operated Blue Screen movable on 200-foot track; and other Auxiliary Effects Devices.

The programming console allows a cameraman to select how all the camera and motion-control devices are to perform simultaneously in harmony on a frame-per-frame basis during continuous or stop-motion photography. Multiple exposure with exact repeatability to .01" allows other effects such as slit-scan and shuttle angles of 360° to be obtained.

Coincident, multi-axis programming is accomplished using a computer to calculate the in-between points to smoothly move all axis on the camera and model stand through key positions related in time by the desired frame number. Data can be entered "by the number" or by positioning the equipment at each station point and "reading" the position automatically—

"ACES" CAMERA CRANE ASSEMBLY WITH AXES IDENTIFICATION





"ACES" MODEL STAND ASSEMBLY INDICATING PITCH, YAW, ROLL AND TRUCK

all axes at once. Frame number relationships allow the computer to position the axes with a linear move, slow-in or out, or any desired in-between program.

Floppy diskette storage provides random data access allowing instant modification and editing of TAKE data.

Movements to follow a point of interest (POI) either fixed or on the moving model stand during a shot can be automatically obtained, as well as auto-follow-focus with at least seven different lenses.

Bulky electro-mechanical devices to achieve nodal point lens rotation have been avoided—yet this feature with any of several lenses can be achieved using the in-between capability of the software or by a special program automatically.

Timesaving routines perform cinex, range, slating, winding forward or reverse to specified frame number, dissolve, cutback, pre-selected or unanticipated pause functions for all system devices.

All system functions are interrelated on a frame basis allowing rehearsal and shooting modes to be performed at any speed between infinitely slow and 24 F.P.S.

CAMERA

The ACES camera is a uniquely designed 35mm unit which uses either a 4- or 8-perforation specially designed-pin registered "Richardson" transport. Film magazine capacity is 400 feet. Taking aperture viewing is available using straight-through or right-angle bore sight (zoom lens finder) or via miniature TV camera.

The Television System utilizes a highly sensitive silicon target camera for "non-burn-in" performance with automatic iris and perspective controls to provide a corrected aspect ratio image for all filming modes. Two monitors—one riding along with the camera, another on the programming console—display either 'live' video or instant replay of rehearsed shots from a Video Tape Recorder (VTR).

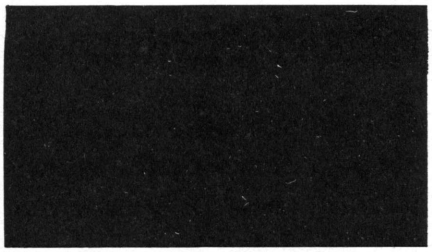
The ACES camera accepts either Leitz or Mitchell BNCR lenses. A follow-focus drive positions the focus mechanism as required for different lens. Currently, seven focal lengths are available within the program, and others may be easily added.

The camera is equipped with a variable blade shutter from 0-180°, externally adjustable to allow dissolves; and an electronic shutter. Exposures may be made from 1/48 second to infinitely long time exposures. The electronic shutter or mechanical shutter can be used for exposure control—the electronic shutter also performs the capping function automatically during re-wind, etc.

The film is transported by closed loop servo motor control allowing film speeds up to 24 F.P.S. and at infinitely slow rates. Multiple exposure control of shutter position to .3° allows either stop-motion or continuous filming repeatability.

Computer camera status monitors insure proper film transport, shutter and electronic shutter operation.

Continued on Page 81



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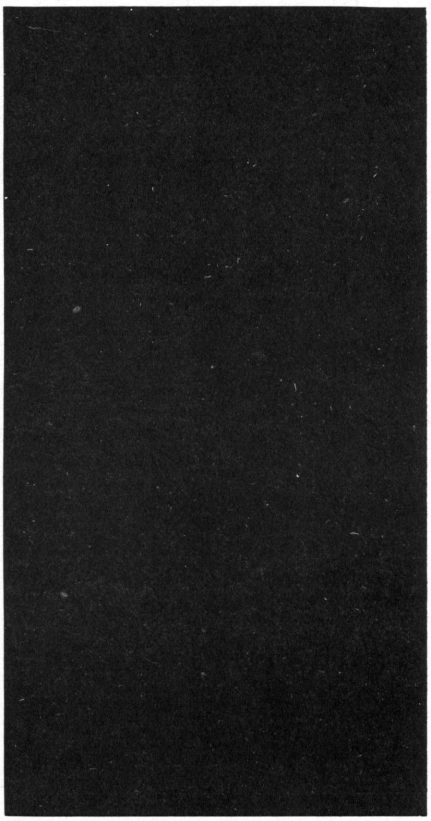

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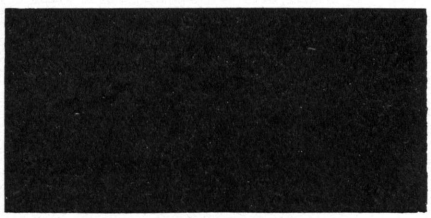

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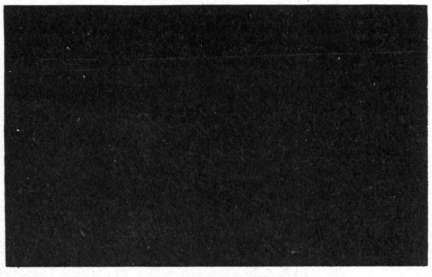

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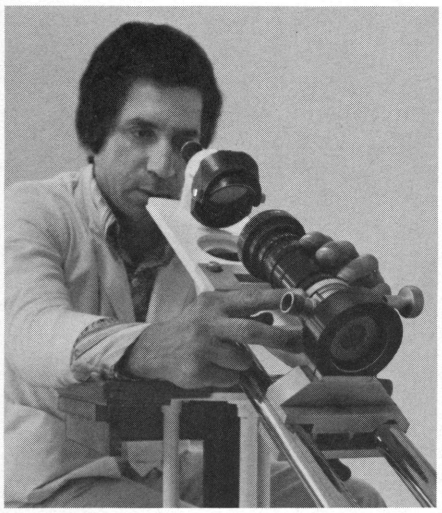

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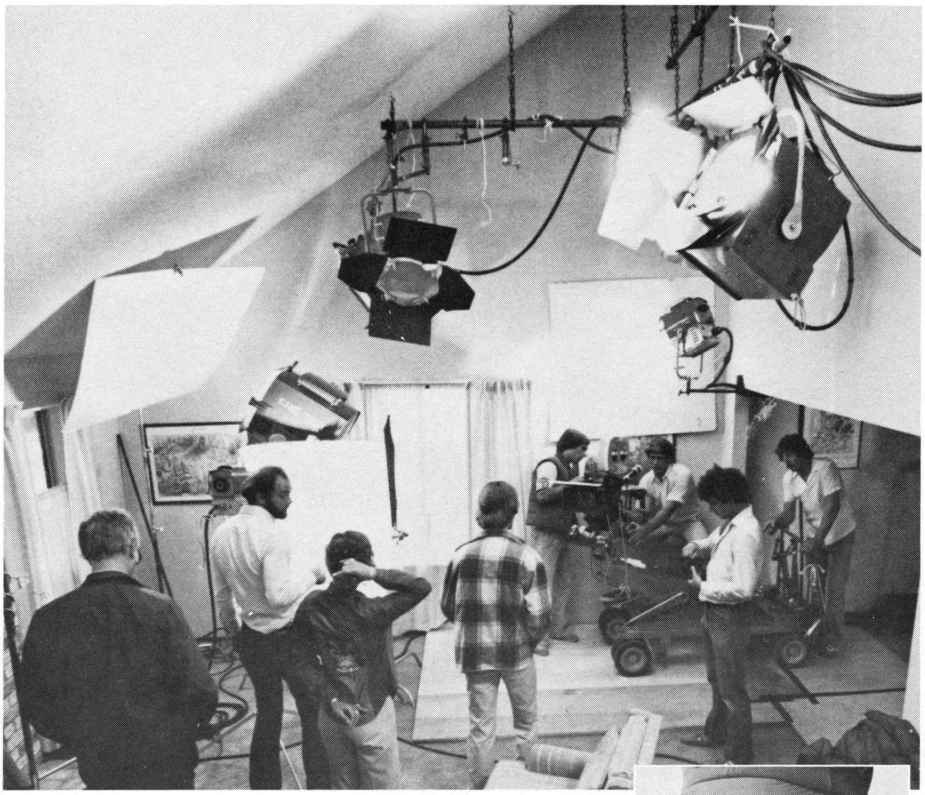
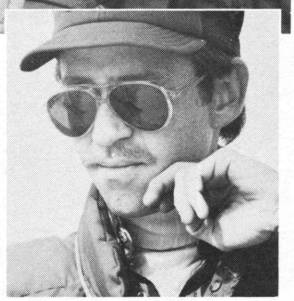
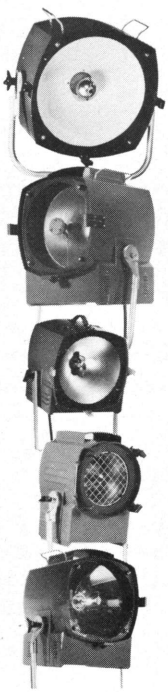


Director of Photography
STEVE POSTER
tells how LTM lights pay off at the bottom line





"LTM's new generation of HMI lights offer so many definite advantages that I have to regard any other choice as second-best. They're just better and more reliable all-around light sources for both studio and location shooting. They give me dependable daylight quality with no flicker problems, no need for window gels, and very little if any call for nets or other devices. LTM has packed a lot of candlepower into units that are much more compact, lighter in weight, easier to transport and handle, and that require only a fraction of the current needed to operate other lights of comparable output. There's no question that a cinematographer has greater freedom and control with them, and, when you get to the bottom line, the net savings to a production more than offset any initial difference in cost."

The innovative film artistry of Steve Poster has drawn considerable attention in an industry that has no lack of outstanding cinematographers. At thirty five years of age, Steve is a fifteen year veteran behind the camera, known as a solid professional craftsman with 'that extra touch' in lighting and camera work that puts scenes of memorable impact on the screen. He has a correspondingly busy schedule; he just finished "Blood Beach" and is currently filming "Dead and Buried." Steve's outstanding work on several award-winning TV spots also keeps him in constant demand for commercials when he can make the time between features.

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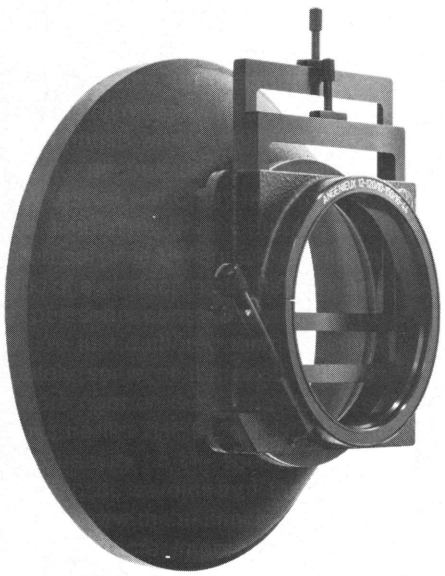

The Lightweight Mattebox has three basic components: a sunshade, a frame and an adapter ring.

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You fit the adapter-ring over the front of the lens barrel and then clamp it tight. Various adapter rings are available, designed to fit Schneider and Zeiss fixed focal-length lenses, plus Angenieux and Zeiss zooms. You can use other lenses, too.

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DIRECTING "BLACK HOLE"

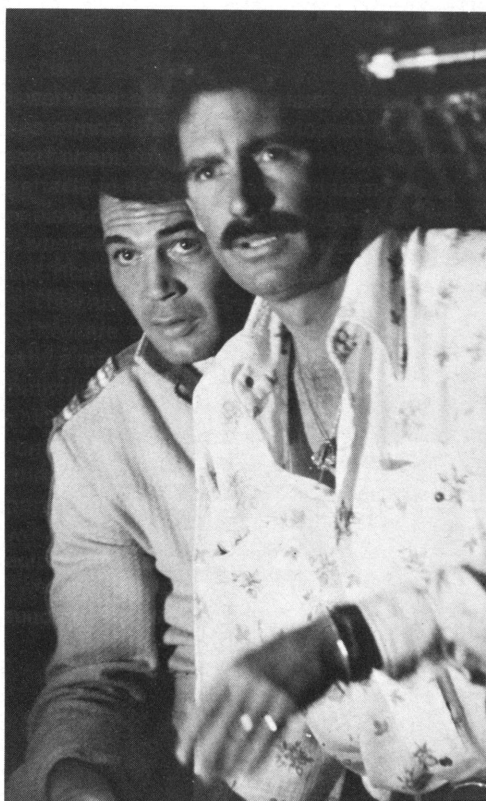
Continued from Page 64

way along the line, especially as regards the visual effects for the ending of the film. These were things that had been talked about only in a very, very broad sense months and months before. Finally we came down to dealing with specifics and every day was a moment of truth in which we were creating at least one element for a sequence that might require a combination of 30 different elements to make a single composite scene.

The effects, of course, were generated by the script and we tried not to stretch credibility too much in the story. But the story itself had come a long way from the original concept, which was a typical Disney format featuring a dog and a boy with a baseball cap. Those elements have disappeared, but we still feel that we can have a high adventure, while proceeding along lines that are somewhat technically correct. We can still have some fun in the film and not be totally locked into a world of reality. We have allowed ourselves room to move within the framework of the imagination.

Working with the Director of Photography on this picture, Frank Phillips, ASC, has been a special pleasure. I've known him for more than 20 years. He photographed the very first television show that I directed in 1961 for HAVE GUN, WILL TRAVEL. THE BLACK HOLE is my first big feature and again he is the cameraman. In the very early stages of pre-production on this film we were discussing who should be the cinematographer and Frank was the obvious

Director Gary Nelson, with Robert Forster "hiding" behind him, appears to be apprehensive about something that is happening on the set.



choice. Not only had he shot many films for Disney, but almost all of them had involved effects of some kind. Disney is a very visual studio and they do more effects there than at any other studio, so I felt fortunate to have a cinematographer with that background who was also an old friend.

Frank is a terrific guy. He has 35 years of experience behind him and you don't find that too often in such a nice person and one who is so competent. It has been a good association for me and, hopefully, for Frank. We had fun on the picture and also, from the photographic standpoint, we did some very interesting special kinds of visualizations. So it's been good for both of us and it's good for Disney too.

For me THE BLACK HOLE has meant a total commitment that extended through the completion of the miniature photography, the sound effects, the dubbing and right up to the end. I couldn't work on it for two years, then walk away to do something else and let it go on. For the last three months I was in the cutting room every day, plus being down on the set for the miniature photography. Toward the end it was hard to be objective and there were moments when I felt like throwing everything out—but those moments passed.

As for the look of the film—a lot of people around Hollywood were saying, "More light! More light!" But we've resisted that. We've gone ahead and created the mysterious atmosphere, the low-key mood that we wanted for the picture—quite contrary to the mood of other Disney pictures. But, then again, the typical Disney film is a comedy. It's "up" and it's bright and comedies are generally lighted in high-key. However, THE BLACK HOLE is by no means a typical Disney film. Therefore, we've been given license to create a mood which, I think, is quite special for Disney and quite special for the film. ■

(ABOUT THE AUTHOR: GARY NELSON returned to Disney Studios for the fourth time to direct his second theatrical release there, THE BLACK HOLE. He directed ABC-TV's, WASHINGTON: BEHIND CLOSED DOORS, for which he was nominated for an Emmy and by the Director's Guild of America as best director. He previously directed three two-part shows which were aired on NBC's Sunday night series, THE WONDERFUL WORLD OF DISNEY. His two-part show, THE BOY WHO TALKED TO BADGERS, got one of 1975's highest ratings. Other Disney shows he directed are THE SECRETS OF THE PIRATE'S INN and BAYOU BOY. His previous Disney feature was 1976's popular FREAKY FRIDAY. Nelson directed many segments of LOVE, AMERICAN STYLE, THE ANDY GRIFFITH SHOW, GET SMART (on which he worked for five years) and THE GHOST AND MRS. MUIR. He also directed the action feature, SANTEE, starring Glenn Ford.)

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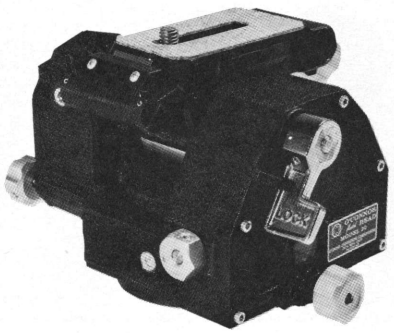

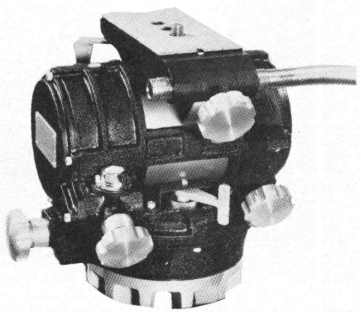

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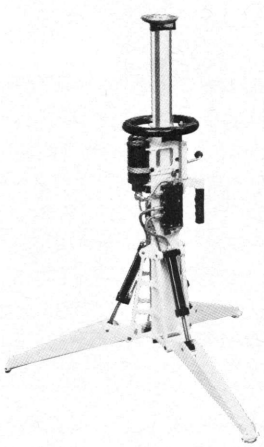

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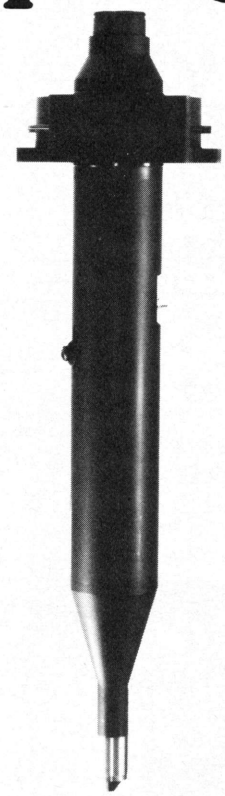

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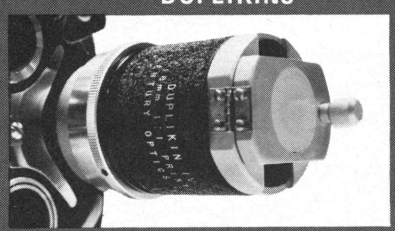

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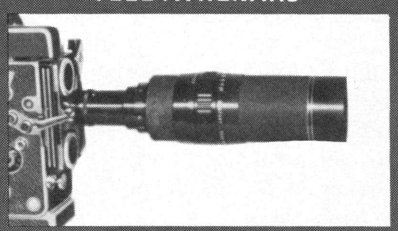

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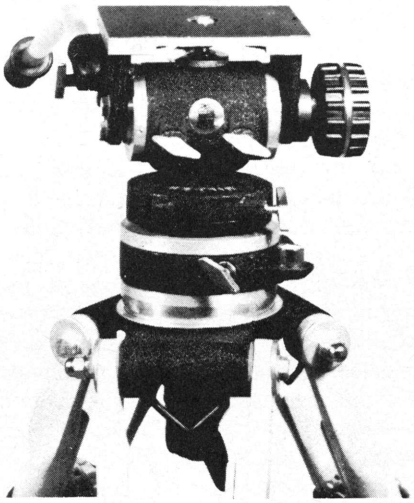

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DISNEY'S NEW MATTE SCAN SYSTEM

A unique high-precision, numerically controlled stop-motion camera positioning device that allows for movement on three axes across a painting and its associated plates with perfect repeatability

The Matte SCAN System is a high precision numerically controlled stop-motion camera positioning device that can operate other associated units in synchronism. Completed this year its perfect repeatability allows for movement on three axes across a painting and its associated action plates. Since Disney uses rear projection and separation masters, a minimum of four exposures for each matte shot are required. Therefore, any move introduced by the "taking" camera must be repeated those four times. Some shots with additional plates and "burn-ins" have been done with over twenty exposures. In every case, Matte SCAN has repeated the move exactly without any deviation. This system has given matte shots a realism heretofore unattainable.

The Matte SCAN System embodies a specially designed, numerically controlled camera crane and auxiliary devices. All six channels of the microprocessor based controller can be individually programmed to coordinate repeated camera and auxiliary devices movements to .001" resolution, thus making truly repeatable sequences possible.

Input to the Control System is via front panel pushbuttons, teletype keyboard or punched paper tape. Positioning requirements once defined can be re-entered a multiplicity of times via the punched tape mode very easily. Editing a take is accomplished by re-entering the modified data points required and can be done at any time.

The axes are named X (Truck), Y (East-West), Z (North-South), Film Transport, Follow-Focus, M (Projector) and Auxiliary. All positioning channels control open-loop stepper motors to achieve the stop-motion action requirements. Operating parameters for movement axes are listed below.

AXIS NAME	LENGTH	POSITIONING ACCURACY	SLEW-RATE
X (Truck)	71"	.001 inches	6 inches/sec.
Y (East-West)	50"	.001 inches	6 inches/sec.
Z (North-South)	26"	.001 inches	6 inches/sec.

Film Transport is provided by stepper motor from infinitely long time exposures to greater than 24 F.P.S. speed. The movement and modified camera is a "Bell and Howell" 4-perforation pull-down animation type. Shutter angle is adjustable from 0-170° externally (not programmed at this time—but available for future automation if required). The camera accepts 400 or 1000-foot film magazines.

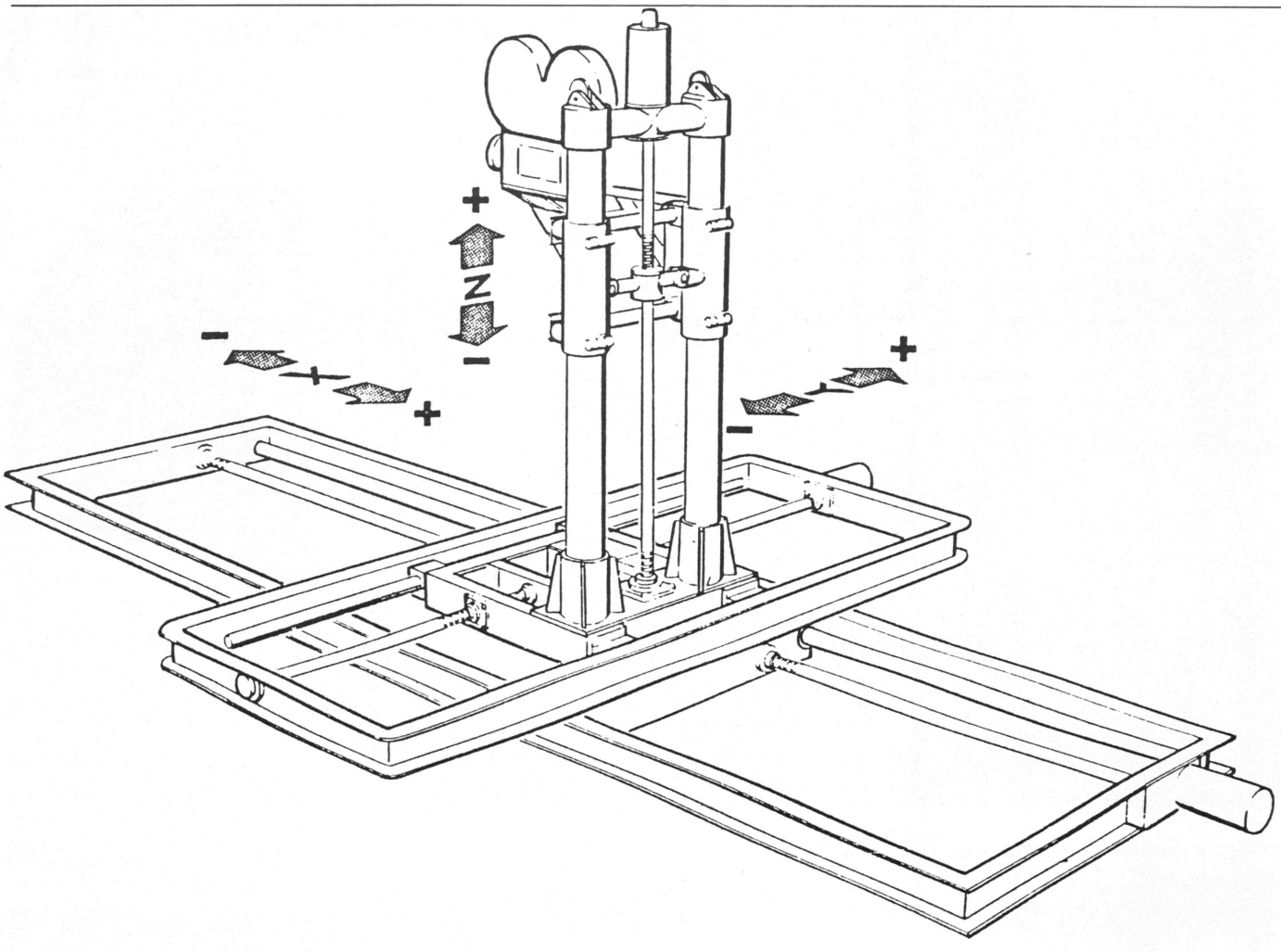
Automatic follow-focus is provided for two lens types at this time. Data input of lens focal length switch code selects the proper algorithm as required.

The special projector control channel advances the associate action plate film with either 4 or 8-perforation pull-down on a frame-per-frame basis automatically. Skip framing at any desired ratio is also available. The projector, although remotely controlled, is self-contained and can be utilized in a stand-alone mode if required.

The auxiliary output channel can be used if needed for special effects devices to be synchronized with other system components.

The Matte SCAN System was conceived and designed for Harrison Ellenshaw by Don Iwerks, Bob Otto and David Snyder. ■

MATTE SCAN CAMERA CRANE, WITH X, Y AND Z COORDINATES INDICATED



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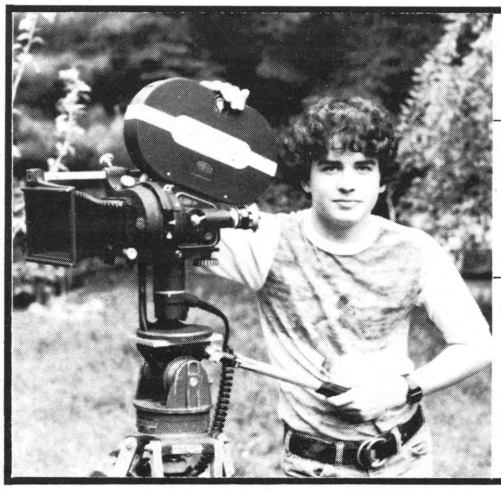
cording to factory preset nominal lens seating specifications, these two dots should line up for proper lens seating. However, in practice, optimum back-focus adjustment usually results in the dots being slightly displaced relative to one another although in many cases they will actually line up after adjustment. If such dots do not exist, reasonable facsimiles should be created by putting minute marks on the ring and barrel opposite one another before the locking screw is loosened. In all cases, the relative position of the indices should be noted with a pencil or tape mark before the screw is loosened.

With the lens at maximum aperture and shortest focal length, and a record made of the previous alignment, the locking screw can now be loosened. Viewing the target through a high resolution viewfinder or monitor, the ring should be rocked back and forth to achieve the most critical focus of the target. Once this is achieved, the indices should be checked carefully.

If a sharp focus is easily determined and the indices are in the same positions relative to one another, retighten the screw and feel secure that the back-focus is probably optimized. However, if the indices have moved, repeat the focusing procedure several times to ensure that the optimum point of focus has been determined properly. If each repeat results in the same point which is different from the original settings or if the point of optimum focus is difficult to determine (a large mushy region of good focus as opposed to a narrow point of critically sharp focus), there is a good chance that the three tubes are not positioned at the same back-focus relative to one another. In either case, determine the point of best focus or choose a point midway between several repeated attempts and tighten the screw locking the ring. If, due to the foregoing, the cameraman believes the tubes may not be optimized for a single back-focus distance, he should take two actions. Get the camera thoroughly checked by technician as soon as possible and in the interim refrain from shooting with wide apertures, if possible. If the camera must be used at near or wide open, the extreme short focal lengths should be avoided.

While the cameraman should never attempt to adjust the back-focus of the individual tubes, there is a simple method to *check* the back-focus of the individual tubes just to assure that they are optimumly adjusted. We will take a look at this method next time. ■



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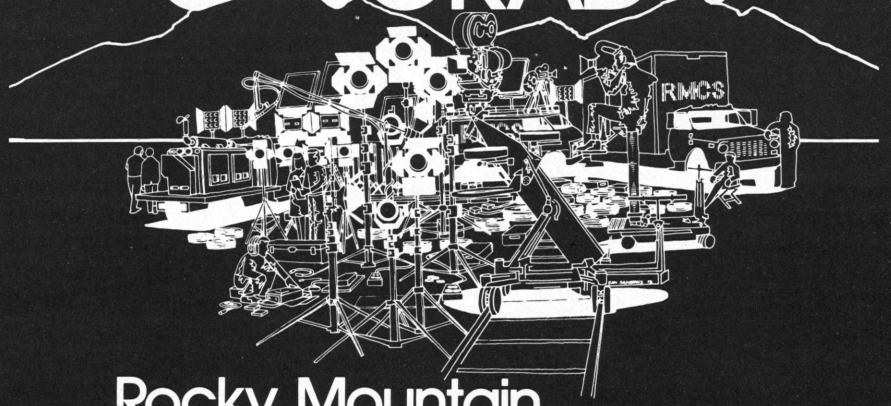

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MAKING THE UNREAL REAL WITH MATTE PAINTINGS

A bit of paint and a whole lot of imagination can add tremendous scope to a motion picture, but painting the matte is only a small part of the operation. Getting it onto film is the real challenge.

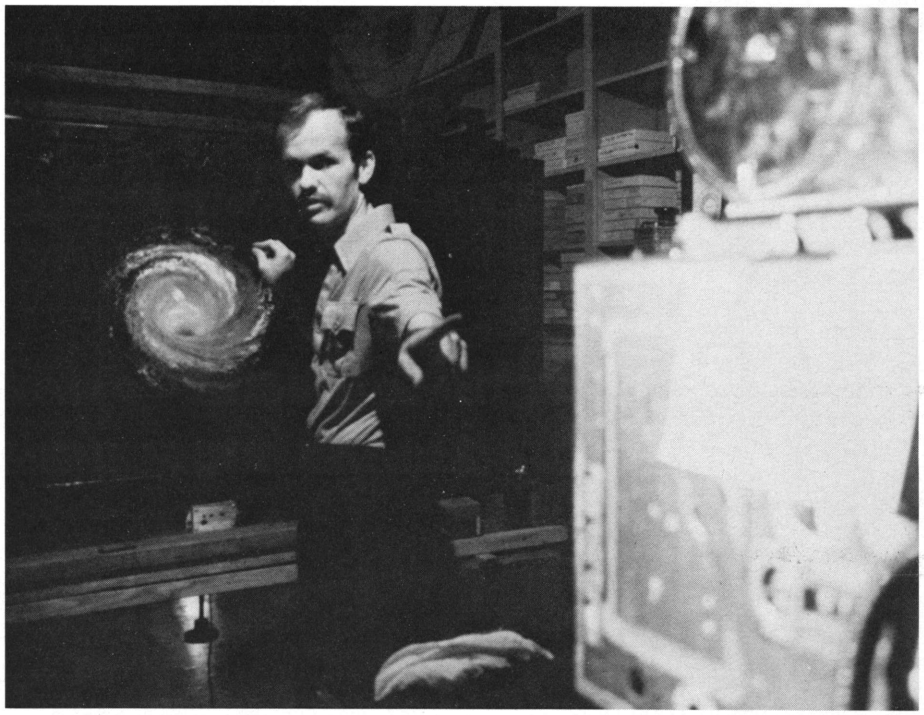
No man has ever seen a black hole, but that did not stop Harrison Ellenshaw from creating one at Walt Disney studio for their epic $20 million deep-space adventure, THE BLACK HOLE.

Making the unreal, real is old business for Ellenshaw. In 1974, Nicholas Roeg asked him to do the matte work for THE MAN WHO FELL TO EARTH. George Lucas approached him in 1976 with an idea for a then highly speculative, little known film called STAR WARS. Ellenshaw remembers that Lucas originally planned seven mattes, but was so taken with the results, that he upped the number to thirteen.

On Disney's THE BLACK HOLE, the number is 150. As a result, Harrison hired every available matte artist and trained new people. The Disney studio now has the largest matte department in Hollywood, employing half the artists in town, working double shifts daily.

Harrison's original career plans did not include the movie industry. His father, Peter Ellenshaw, is an Academy-Award winning matte artist, production designer and director of special effects. Young Ellenshaw took a psychology degree in college and then joined the Navy. After discharge, the only job of interest was in the matte department at Disney under Alan Maley. Maley taught Harrison the fundamentals of painting and matte work and when he retired in 1974, Harrison replaced him as head of the department.

Harrison's credits include BIG WEDNESDAY, PETE'S DRAGON, HERBIE GOES TO MONTE CARLO and THE CAT FROM OUTER SPACE.



Harrison Ellenshaw working on the filming of a matte painting for THE BLACK HOLE. The son of famed matte artist Peter Ellenshaw, he is obviously "a chip off the old block", but is very much his own man and a respected artist in his own right. A total of 150 mattes was required for THE BLACK HOLE.

QUESTION: Why are there so many matte shots in THE BLACK HOLE?

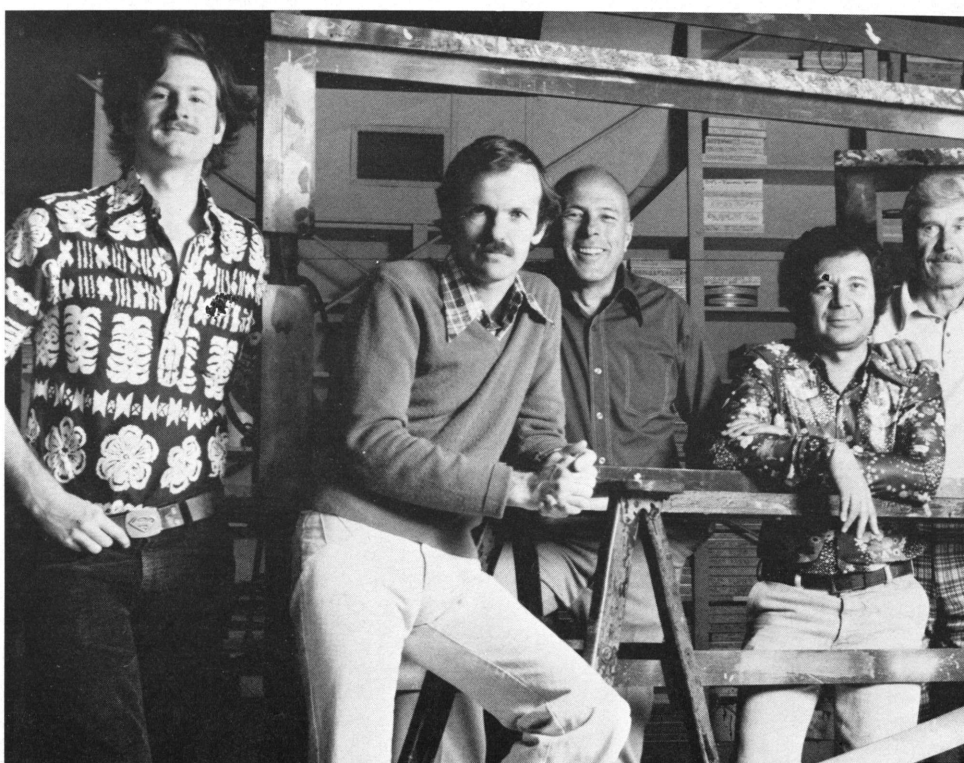
HARRISON: The Cygnus was designed with few corners in it and it was very long—one main corridor extended the entire length of the ship, 1,000 feet. Obviously, something this size could not be constructed as a full set. But the story demanded it, and it allowed us to have a big dogfight with the robots.

A good 70 feet of set was built and we extended it with mattes to the full 1000 feet. So just in the main corridor alone, we had some 30 matte shots in addition to transitional shots and chases in other corridors.

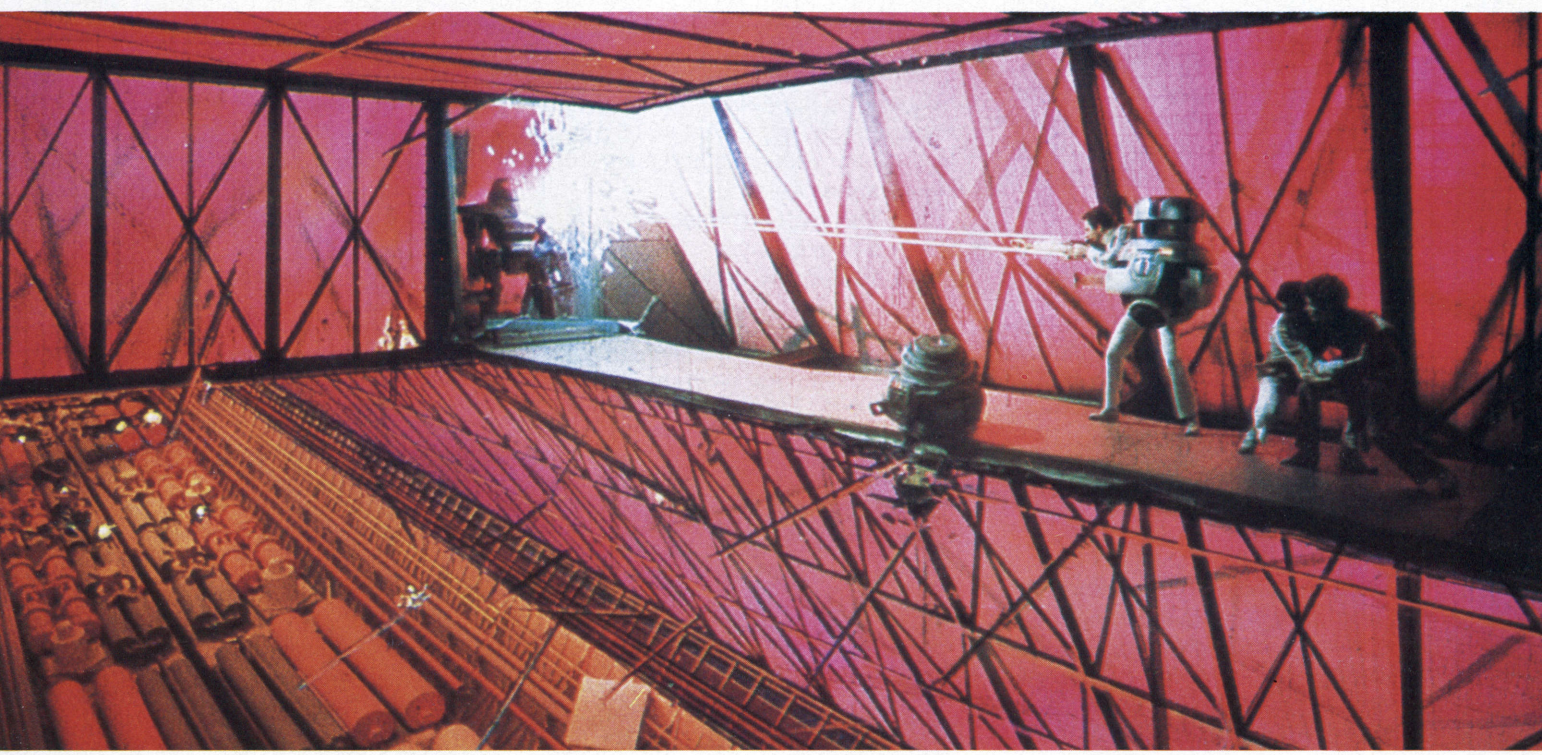
The second reason is the black hole itself. It is a combination of many elements and effects. The main element, the center, was done in a large tank and shot 15-times normal. We took that, looked at it and it was still going too fast, so we tried to double frame it, but it was too jerky. So we experimented and found that a cross dissolve worked out very well. We shot the footage twice, half-exposure each time through. The first time, we exposed the first frame and then the second frame for the next three successive frames,

Continued on Page 88

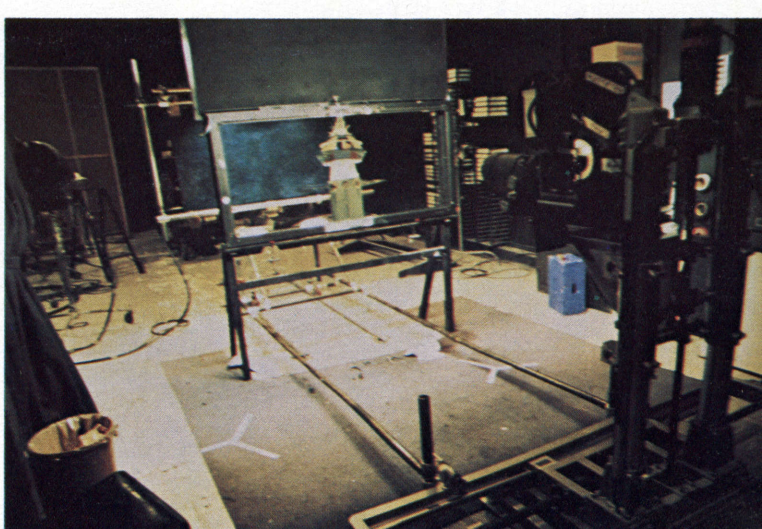
Members of the Matte Department at Walt Disney Studios include (left to right): David Mattingly, Harrison Ellenshaw, Don Henry, Deno Ganakes and Ed Sekac. The Disney Studio now has the largest matte department in Hollywood, employing half the artists in town, working double shifts daily.



A scene in the main corridor of the U.S.S. Cygnus, which is supposedly 1,000 feet long. Approximately 70 feet of foreground set was built. The rest is a matte painting. In the main corridor alone there were some 30 matte shots, in addition to transitional shots and chases in other corridors. (BELOW) Rival robots engage in what Ellenshaw calls a "dog fight". Here again, except for the relatively small area where the live action is taking place, the bulk of the set is a matte painting. Such paintings can greatly enhance production value at relatively low cost.



(LEFT) Dave Mattingly painting a matte in the Disney Studios Matte Department. The paintings are not highly finished, because the film is capable of resolving only so much detail. Many matte shots incorporate multiple elements, including live action and miniatures. (RIGHT) The MatteSCAN camera mount set up to shoot matte painting of the U.S.S. Cygnus tower. MatteSCAN (Matte Specialized Camera Automated Numerical) is a motion-controlled camera stand that moves along three axes.



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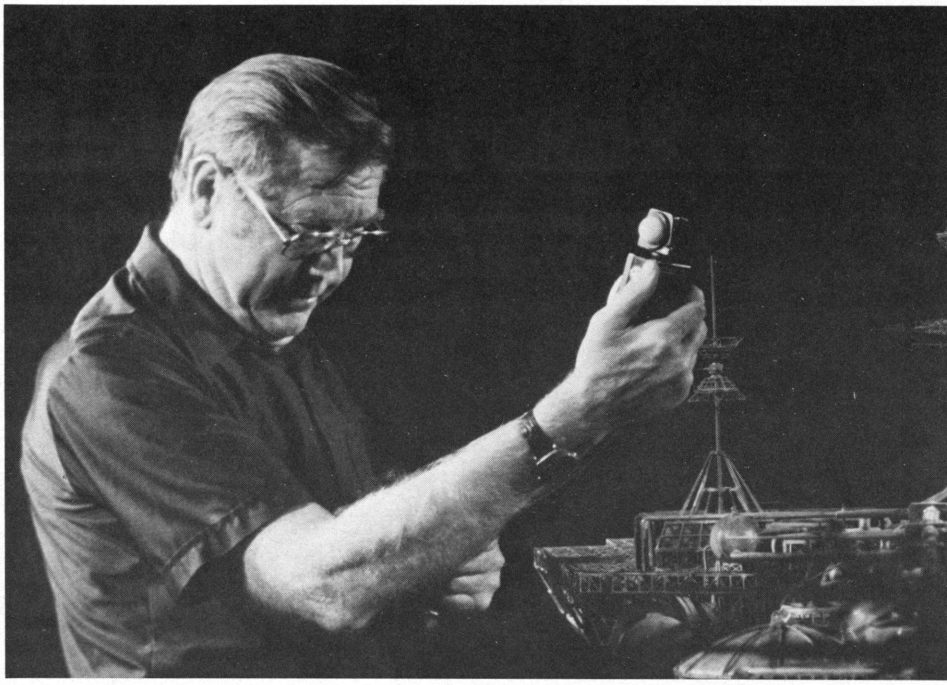
was made. The plan was handed over to Danny Lee and his mechanical effects crew and they built the miniature. The interior lights of the miniature were installed by the mechanical effects people. They were rheostat controlled, so that I could modify the density of light within the Cygnus. I generally started with the amount of light that we had on the star backing and then I lit the Cygnus so that its outside structure appeared to be slightly darker. To illuminate the exterior of the spaceship, I practically used the ambient light that was in the room, approximately 15 footcandles.

The fact that Peter Ellenshaw wanted the spaceship to read almost as a silhouette (except for its interior lighting) against a lighter star backing is the reason why the exterior was lighted so dimly. The low-level ambient light was just enough to prevent it from going totally black, but if we'd used any more it would have overpowered the light that was coming from the interior.

The amount of light that was on the star backing determined the brightness of the lights inside the Cygnus miniature (controlled, as I've said, by rheostat). The star backing was both front-lit and back-lit. In general, the appearance of the stars was controlled by the number of holes we had punched in the backing, and then I hung diffusers in back about six feet to the rear of the backing. We moved in 500-watt lighting units on stands to get about 75 footcandles on the front of the star backing.

The calculation of exposure for these miniature sequences involved several technical considerations. First of all, I feel that the worst thing that can happen in miniature cinematography is to have any part of a model or miniature set out of focus. That's a dead giveaway that it's a miniature. Consequently, you have to stop down considerably in order to hold depth of field over the entire miniature—something on the order of f/22. Stopping down that far required, in some instances, an exposure of 24 seconds per frame, and when the Cygnus was in movement, we had to have a "settling time" to allow for both the camera and the miniature to settle down after the automated camera system had made its move. So, for many shots, I was getting two frames per minute.

I would say that the success of our miniature shooting on THE BLACK HOLE really resulted from our use of the Pitching Lens developed by Continental Camera Systems. A Pitching Lens is a prime lens of any focal length you choose, plus a relay system, plus an anamorphic converter. It is similar in configuration to the Kenworthy Snorkel and Magicam systems except that the taking lens is at the bottom of the relay tube, a significant difference.



Cruickshank takes a meter reading on a miniature of the U.S.S. Cygnus. Whereas he had always been used to shooting miniatures after the First Unit had completed its work, on THE BLACK HOLE the sequence was often reversed and he shot miniatures without knowing exactly how the tie-in live action would be lighted.

The Pitching Lens enabled me to get within a paper thickness of the Cygnus miniature in many shots. It just cleared the model by a 32nd of an inch. The 20mm Pitching Lens, when stopped to f/22, carried focus from one inch to 20 feet. Of course, in order to shoot at f/22, we actually had to light for f/32, because you lose a stop through the optical system.

Given a choice, I had always preferred

Cruickshank (center) spent a good deal of time on the live action sets to observe how this action was being lighted and photographed, in order to achieve the best possible match with his miniature photography. His very close rapport with Director of Photography Frank Phillips, ASC, and their constant exchange of information made the blend of their talents very successful.

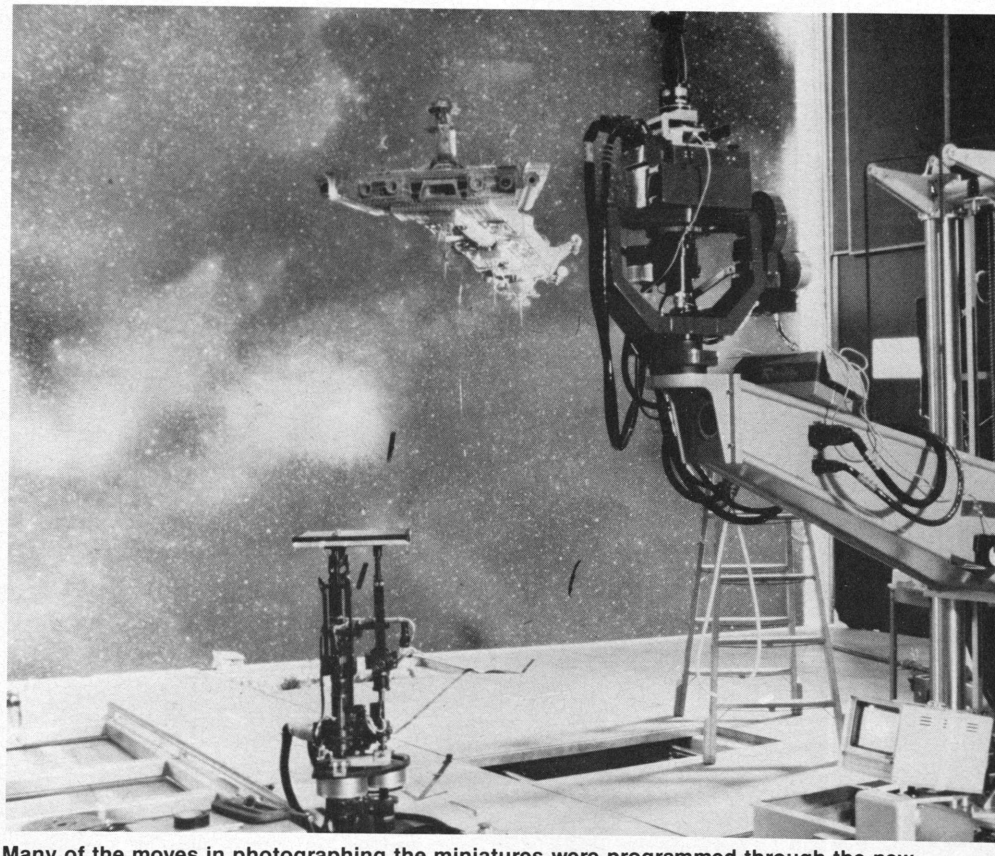
to work with the largest-scale miniature possible because of the focus problem. You obviously have a better chance of carrying focus with a larger miniature. However, I had never used a Pitching Lens until this picture. Now, as a result of that experience, I wouldn't hesitate to reduce the scale of the miniatures because of the tremendous depth of field that this lens has.

The one disadvantage is the necessity for stopping down to f/22 and the long exposure time that is required at that stop. If it takes 24 seconds to shoot one frame and you get two frames per minute (including the settling time), then, at the standard rate of projection (24 frames per second), it would take you 12 minutes to shoot one foot of film—which is what happened many times. Of course, since I had a machine doing it, I didn't exactly have to stand around and wait. We had our computer experts and two excellent operators on the ACES camera, Bill Kilduff and Bob Wilson, who struggled through many, many patient hours sitting there watching the Automated Camera Effects System go through its paces.

Our schedule got so short by the time we were ready to use the ACES equipment that we didn't have time to give it a shakedown cruise. When ACES was delivered to us, we checked it out to make sure that all of the axes worked, but we immediately started to present production problems to the ACES program. In one case we thought we could leave the thing overnight and come back in the morning and continue the take. The Cygnus model weighed 175 lbs. and it was balanced on the miniature stand at its center of gravity. I had programmed a move into the Cygnus that called for a 15-degree pitch from the center of gravity. We left that overnight and continued the take the next morning. We found a jump in the time that it had been standing overnight, so the take had to be discarded. It was too bad, because that was a 15-hour take.

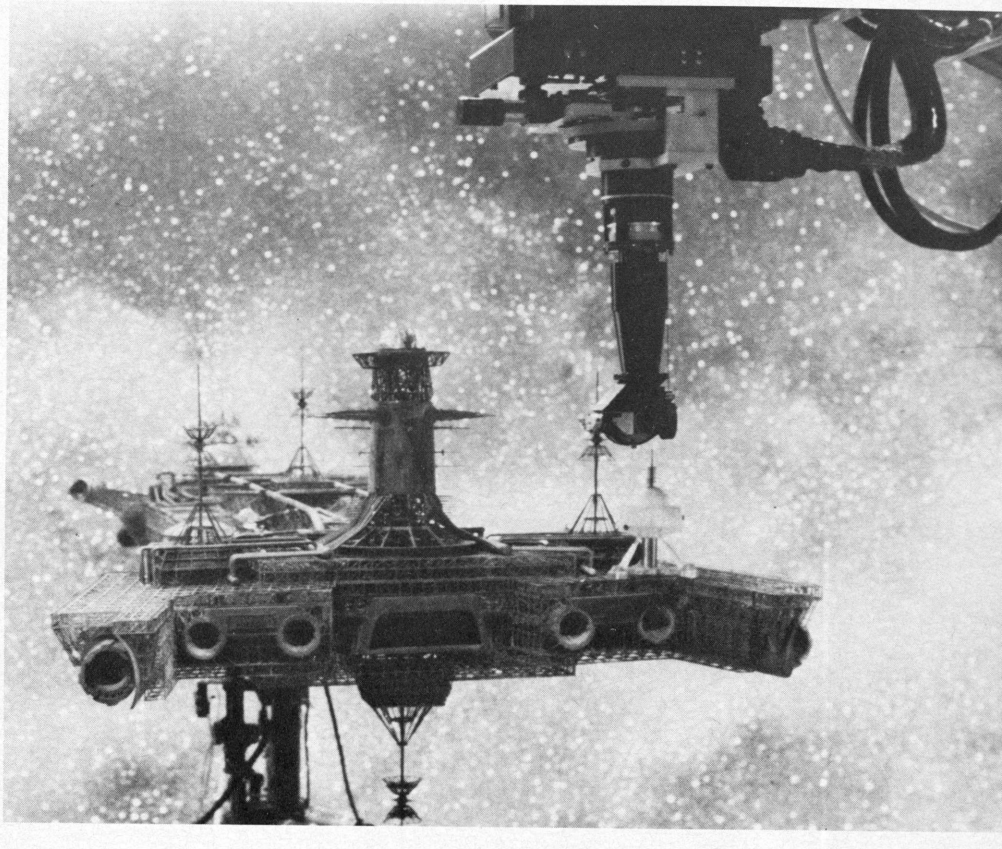
That was an instance where I tried something that I shouldn't have tried. I should have had more sense than to expect a machine to stay in its proper position with that much weight over any period of time. However, in order to enable us to do that on frequent occasions, the machine shop came up with a method of supporting the Cygnus by means of tie rods.

There are a good many explosions incorporated into the miniature sequences of the BLACK HOLE, and these miniature explosions (which are difficult to make look like their full-size counterparts) were entirely in the hands of Danny Lee and his mechanical effects people. However, Danny would always



Many of the moves in photographing the miniatures were programmed through the new Automatic Camera Effects System (ACES), developed by the Disney organization especially for production of THE BLACK HOLE. The computerized equipment was the product of input from several top technical minds. It made possible effects that had never been achieved before. The ACES equipment has 18 axes of movement available, including those of the camera, the miniatures and equipment that is not part of ACES.

The Pitching Lens, developed by Continental Camera Systems, mounts a prime lens at the bottom of a snorkel-type relay tube. With a 20mm lens mounted, the equipment has a depth-of-field from 1 inch to 20 feet (with the lens stopped down to f/22). Although this required lighting to f/32 and exposures as long as 24 seconds per frame, the results were worth it.



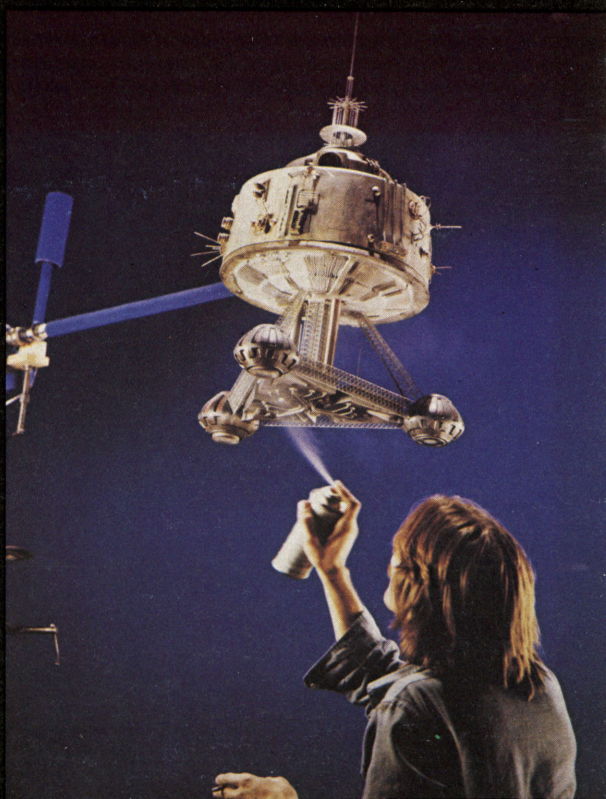
Following the concept of Production Designer Peter Ellenshaw, the miniature of the Cygnus was photographed almost in silhouette, with the main illumination (on rheostats) coming from within the model itself. The exterior received ambient light of only about 15 footcandles. For purposes of balance, the amount of light that was on the star backing determined the brightness of light inside the Cygnus. The star backing was both front-lit and back-lit.

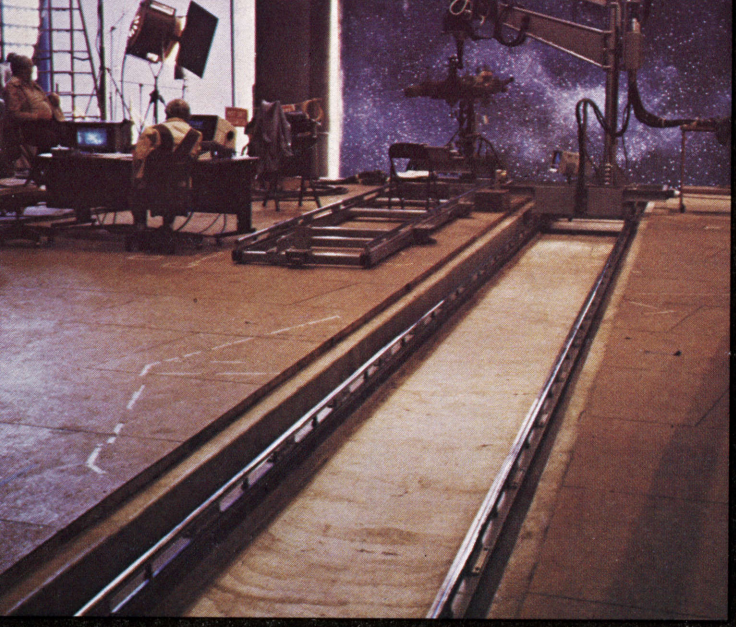
set up a demonstration for us and, if the material behaved in the manner that we wanted it to, we would okay it. Danny is a great man with explosives and very seldom would he give us a demonstration that we would turn down. So, having seen it, we would then install it on whatever we wanted to demolish and proceed with the photography.

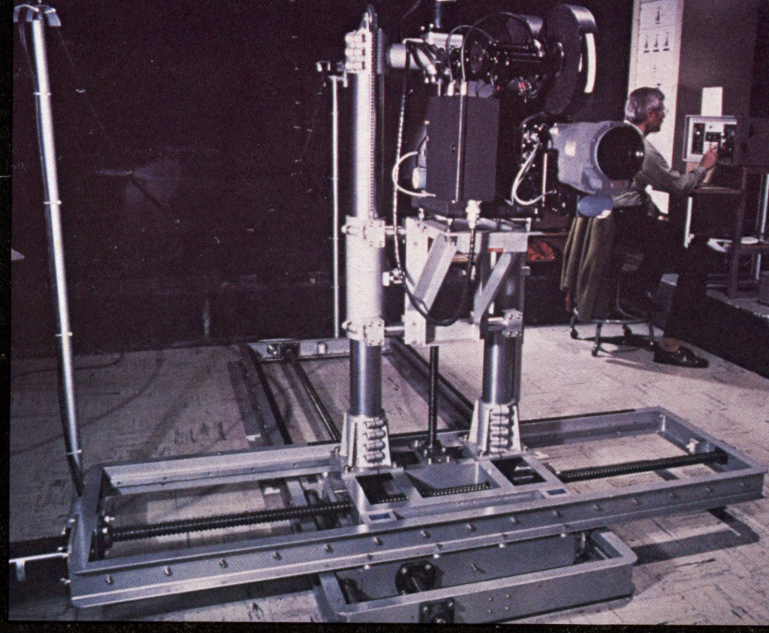
Sometimes these explosions were shot separately and added optically. In other cases, when the scale of the miniature was sufficient so that we could get close enough to it, we would add the explosion directly. When the power plant blows up, for instance, what is on the screen is a completed shot within itself, as far as the explosion is concerned. I should like to say that the animators at Disney Studios did an excellent job of animating additional effects to the explosions and they also animated the "zaps" in the laser beams and the trick game in the shootout sequence, when the robots challenge opposing robots to a game of, shall we say, laser billiards.

Continued on Page 100

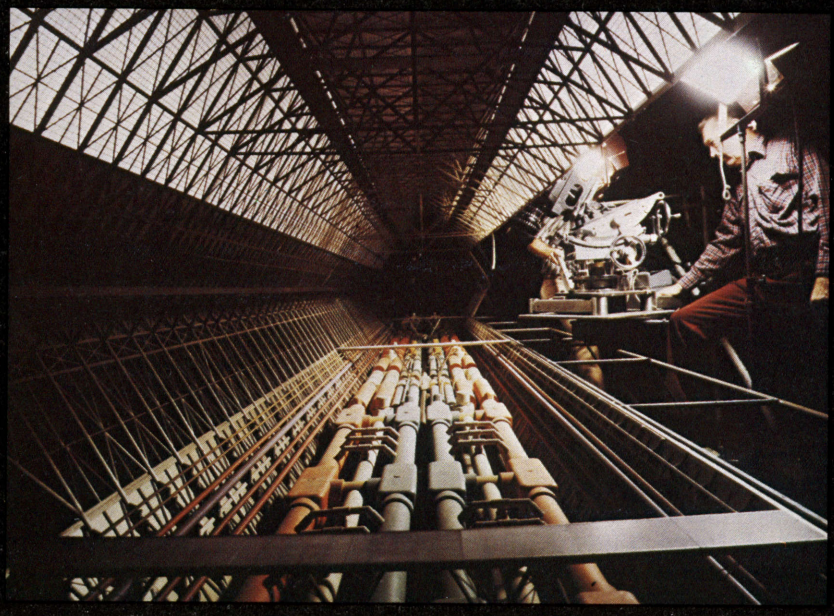
(LEFT) Technician sprays the star backing, which was not black, but deep blue. The appearance of the stars was controlled by the number of holes punched in the backing and backlighted with sometimes as much as 1,250,000 watts of light. Front-lighting was about 75 footcandles. (RIGHT) A spray can adds a finishing touch to miniature of the Palamino spacecraft, the ship which finds the derelict Cygnus in deep space.

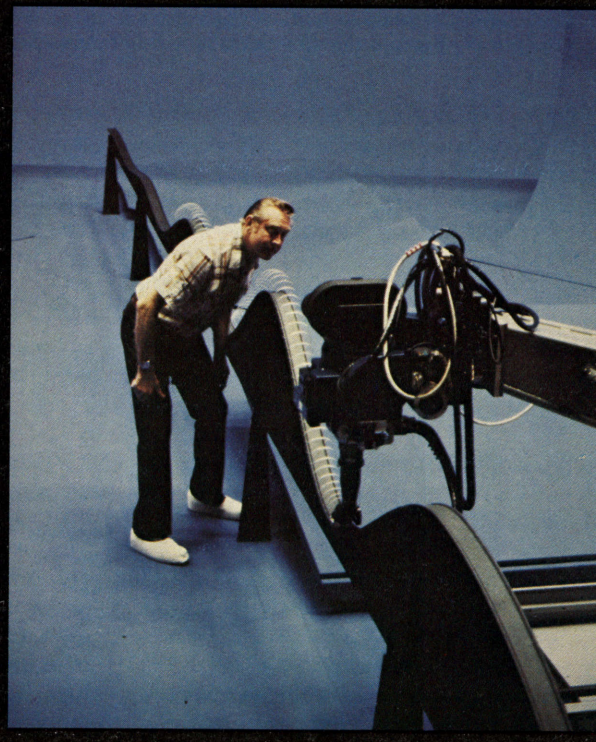




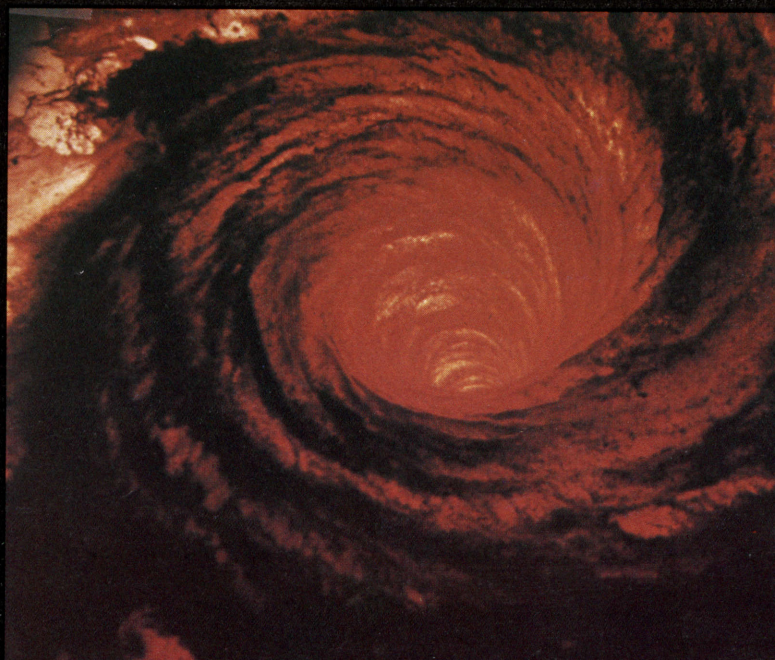


(ABOVE LEFT) The ACES equipment, permanently mounted on its 66-foot precision track. (RIGHT) The Matte-Scan crane, also developed at Disney Studios, was most helpful in filming THE BLACK HOLE. (BELOW LEFT) Cruickshank plots a shot inside miniature of the main corridor of the Cygnus. (RIGHT) Pitching Lens mounted on ACES crane prepares to shoot miniature scene.





(LEFT) The Black Hole itself was created by means of a vortex in a six-foot circular tank that was six feet deep. (RIGHT) Red and black paint was dropped into the vortex, which had to rotate very rapidly in order to create the proper effect. However, it was required that the Black Hole appear to be turning very slowly. This was achieved by shooting the scene at 360 frames per second (15 times normal speed), using a Photosonics Model 40 35mm camera, and later double-framing the scene so that the action was slowed down 30 times normal.



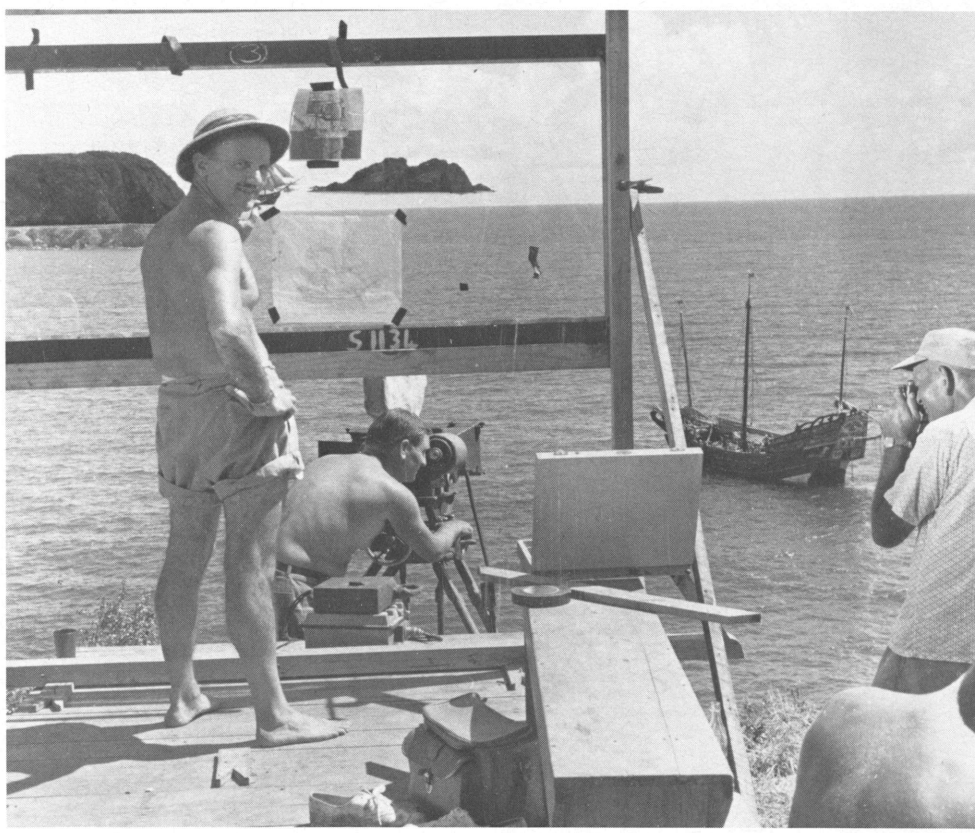
years to get; it was the story. As always, with these adventure films, it was extremely difficult to get a viable story that really flowed, one in which you could have sympathy with the characters. Very often, in vehicles like this, the backgrounds quite overpower the human aspects of the story. So it was very difficult to get a story line that would please everyone. Quite often, during this period of planning, I would only come in for a couple of days a week. At times we would feel that we would never get the story right and that we would never make the film. However, getting an interesting design on the original concept helped us feel that maybe we could make something that was pictorially interesting and that, if we could whip the story, we could still continue. The idea of the film itself kept us going, I should think.

QUESTION: As I understand it, most of the action of THE BLACK HOLE takes place onboard the giant derelict spacecraft U.S.S. Cygnus. Can you tell me a bit about how the design for that spacecraft evolved?

ELLENSHAW: When I first came onto the picture they had had Bob McCall, a well-known illustrator, working on a design for a spacecraft for three months. I took his basic design and modified it, because I felt that there were things that we should do to keep it from looking like all the slab-sided spacecraft we had seen in other films. I feel that in the future we won't bother to cover every part of the ship with slab steel or plastic or whatever; we will let the ship reveal its own form. For this particular spaceship I felt that we should have a skeleton that is on the outside of the ship, so that they could get at any part that they wanted to work on; the interior is slab steel. Actually, the ship, with its multiplicity of struts and girders, presents a very interesting cinematic image.

QUESTION: Was there anything that particularly inspired you toward that "ektoskeleton" concept for the spacecraft?

ELLENSHAW: I really got my concept from a number of sources when I was searching for a way to go, but one of them was the Goldstone Tracking Center where they have those huge bowls, radio telescopes that are held together by this same method of struts. It made a beautiful framework and I felt that maybe we could capture some of that delicacy, that look of intricate tracery—almost like a spiderweb—and that's how I came around gradually to that concept.



Peter Ellenshaw painting a matte for IN SEARCH OF THE CASTAWAYS (DISNEY, 1962). (BELOW) Ellenshaw on location on the island of Tobago painting a glass matte for SWISS FAMILY ROBINSON (DISNEY, 1960). Note the miniature ship in the water at right. Ellenshaw tried retiring in 1973 to concentrate on "serious" painting, but was lured back to work on THE BLACK HOLE in 1976.

QUESTION: All of your design sketches for the picture that I've seen appear to be very low-key—quite different from the usual Disney high-key look. Can you tell me more about that?

ELLENSHAW: I felt that the picture should have a sense of "mysterioso" and that this could be achieved mainly by lighting it in low-key, rather than having it brilliantly lit the way that master of all

space movies, Stanley Kubrick, did in his benchmark film, 2001: A SPACE ODYSSEY. He lit his film harshly and bright because his single source was the sun, but the action of THE BLACK HOLE takes place outside the solar system, so we can't have our spaceship lit in that same way. It is lit by starlight, one might say, rather than by a sun. Of course, all stars are suns anyway, but they are so far away in our concept that we couldn't use the same kind of lighting that Stanley Kubrick did. I really think he made a marvelous picture, and it's the best ever as regards authenticity.

QUESTION: I get the feeling that you will be working on final effects for THE BLACK HOLE practically right up to the preview. Am I right?

ELLENSHAW: Probably, because that's the usual thing on films with such a multiplicity of intricate effects. I remember that when I was working on a picture called ELEPHANT BOY, with Sabu, they had a problem with the censor because there was one scene in which he was completely naked. The censor felt that some of his human anatomy should be removed, but when we removed it he became a woman—which wasn't right either. So eventually we had to put a drape around him and this took a little while. At last we managed to get it looking all right and I drove up to the lab on my motorcycle and got the film that was to be cut in for the opening the next day. On this picture it could easily mean that we will be refining the end until the very end. I'd like to give ourselves time to make sure that the end is going to make it all worthwhile, because in this picture it's got to be. We have to prove that we are coming up to expectations. We've called the damned thing THE BLACK HOLE, so we've got to do a decent Black Hole.

QUESTION: What can you tell me about the interior design of the spaceship?

ELLENSHAW: I tried to make the computers a little different from the ones you usually see. We tried to avoid having them flash meaninglessly. Our lights don't just flash like idiot lights that have no meaning. We tried to keep the computers under control, rather than having them too obvious. As for the interiors themselves, the slab structure is more noticeable inside, with the skeleton outside. We have emphasized the fact that in space you get a tremendous opportunity to have huge areas, because they can build those areas as large as they like without any real trouble. In fact, they

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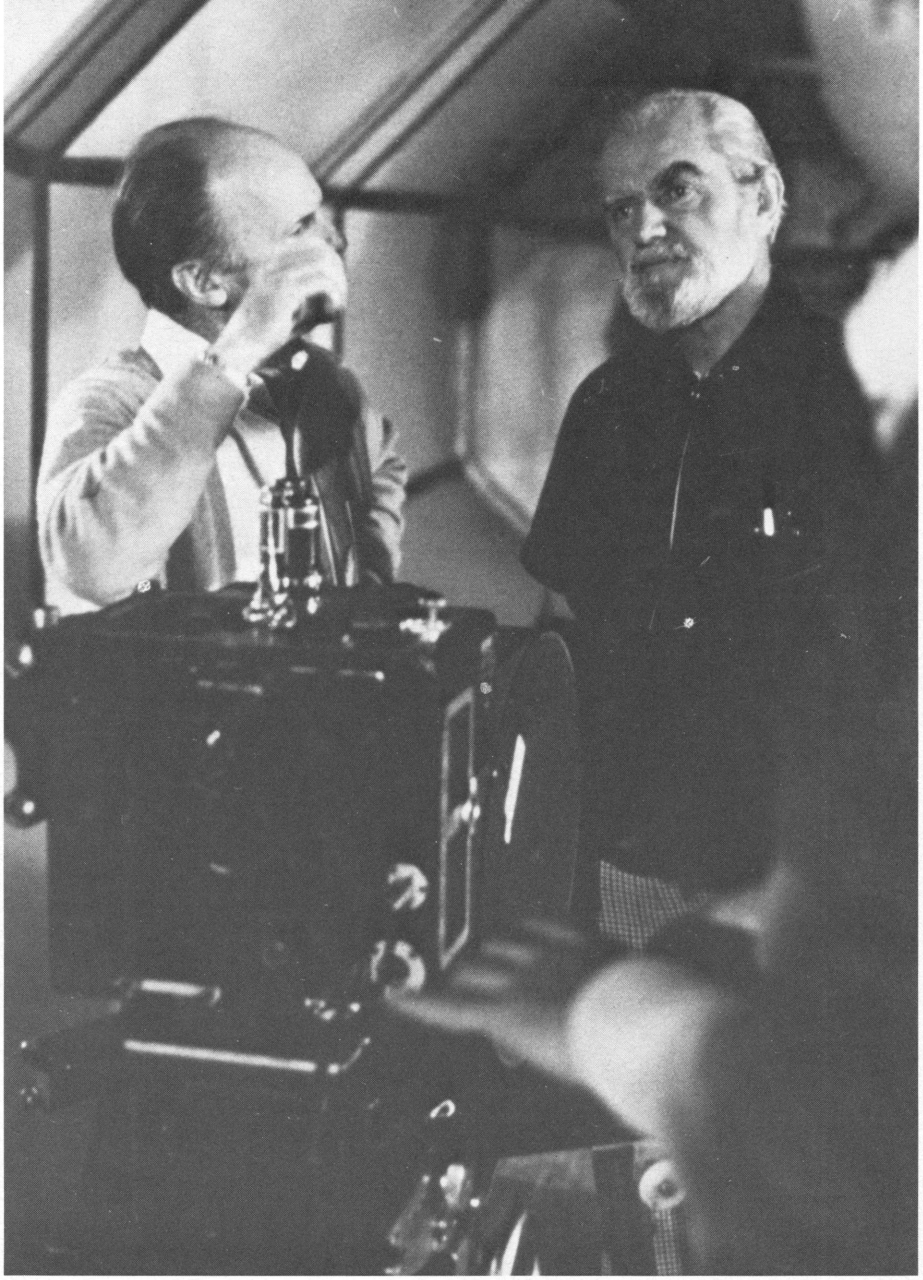


Ellenshaw confers with Frank Phillips, ASC, Director of Photography on THE BLACK HOLE. Because the two artists have worked together for so many years on so many Disney features, they have an extremely close creative rapport. (BELOW) John Mansbridge and Al Roelofs, Art Directors on THE BLACK HOLE, shown with small-scale mock-up of one of the interior sets.

FROM "SNOW WHITE" TO "THE BLACK HOLE"
Continued from Page 53

QUESTION: You mean the effects involving the leprechauns?

LYCETT: Well, we did what we call mixed scale . . . and we used mirrors . . . the sort of stuff that worked great, but you couldn't use the method these days because production costs on the stage are so high. The mixed scale shots take hours to set up. These days you've got to do your fooling around later in the lab. Get the thing shot and get off the stage.

QUESTION: You received an Academy Award for MARY POPPINS. What, from your standpoint, was the greatest challenge in that film?

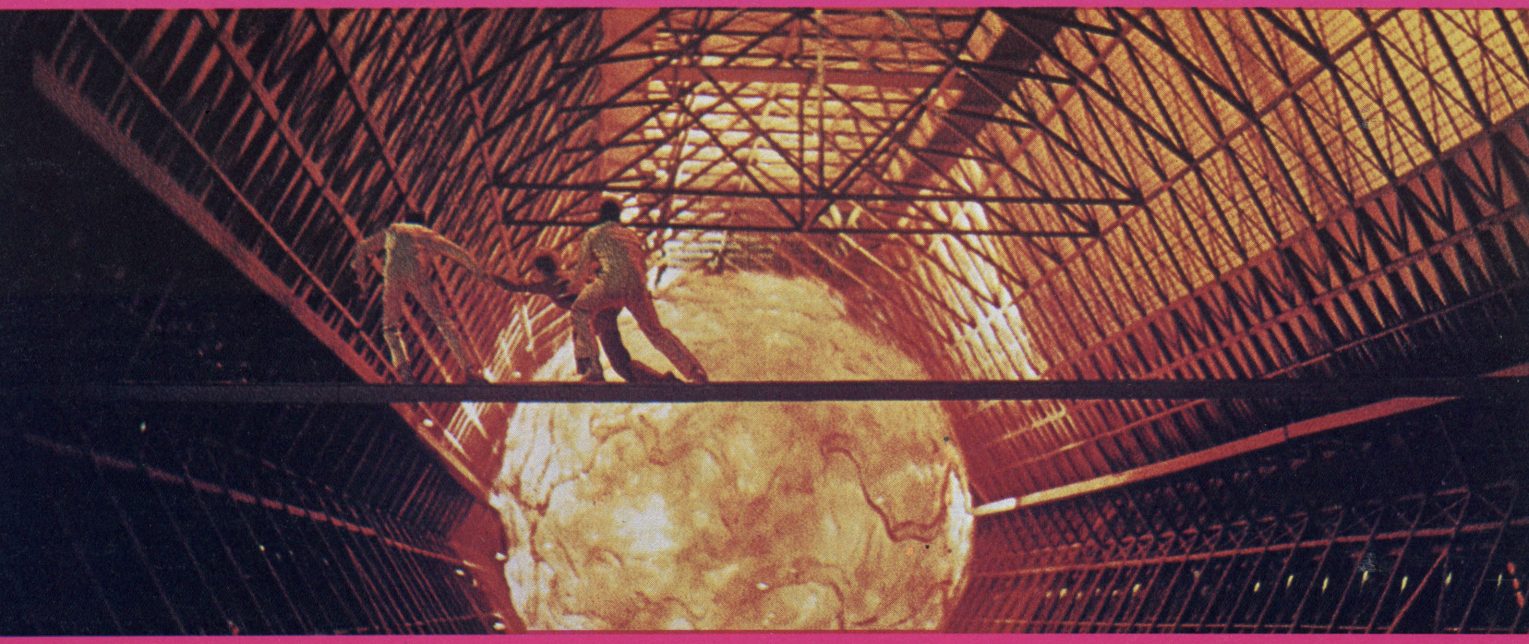
LYCETT: The toughest job was combining live-action with animation. That's always tough to do—you can overlay cartoon over live-action, but to make live-action people go around a cartoon and to make them look as if they're in a cartoon set takes a lot of time.

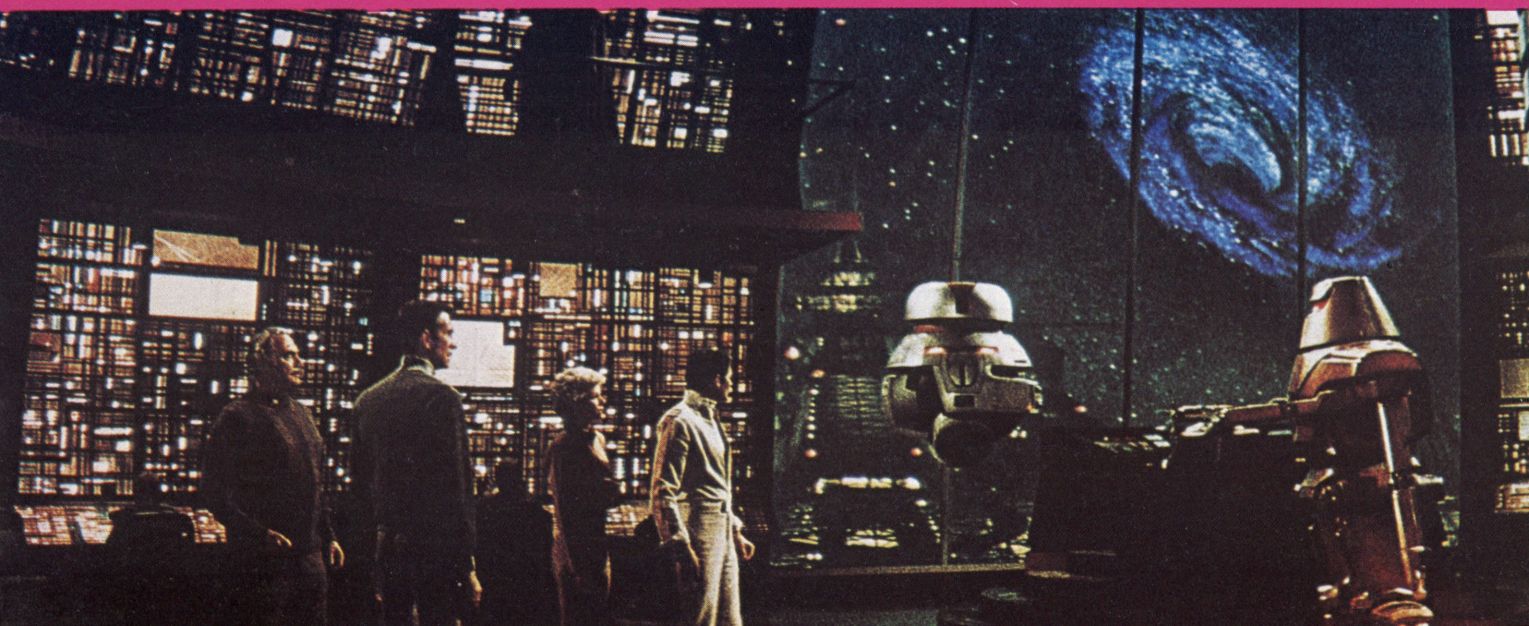
QUESTION: Must be a challenge for the actors.

LYCETT: Julie Andrews and Dick Van Dyke had to work on a practically empty set. We had detailed sketches of what the composite scenes were to look like. We'd have the actors work in a restricted area of the frame which we could see by looking through the camera. Because Bob Stevenson was a very meticulous director who could visualize pretty well, that helped. But it was still quite a job. When Andrews and Van Dyke were stepping on cartoon turtles they were actually stepping on black pipes—they'd give us some funny looks. I even had Walt come down one day and he came to me and said "Do you know what you're doing?" and I said, "Boy I hope so!" (laughs)

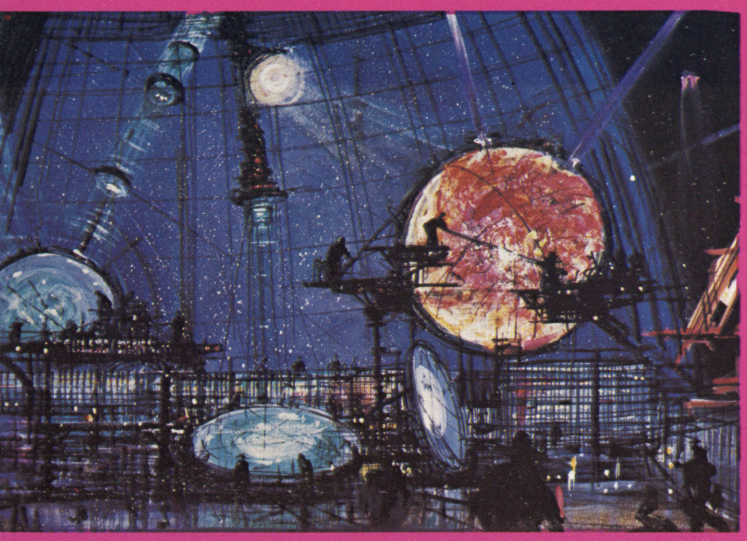
QUESTION: Has THE BLACK HOLE made even greater demands on you?

LYCETT: Well, I'd say so, especially in terms of quantity. At last count we had 300 blue screen shots; and in addition to that there's all the animation. Every laser scene is an optical scene—we have to put it together after the animators animate it. I would guess that we have well over 500 optical scenes in the picture.

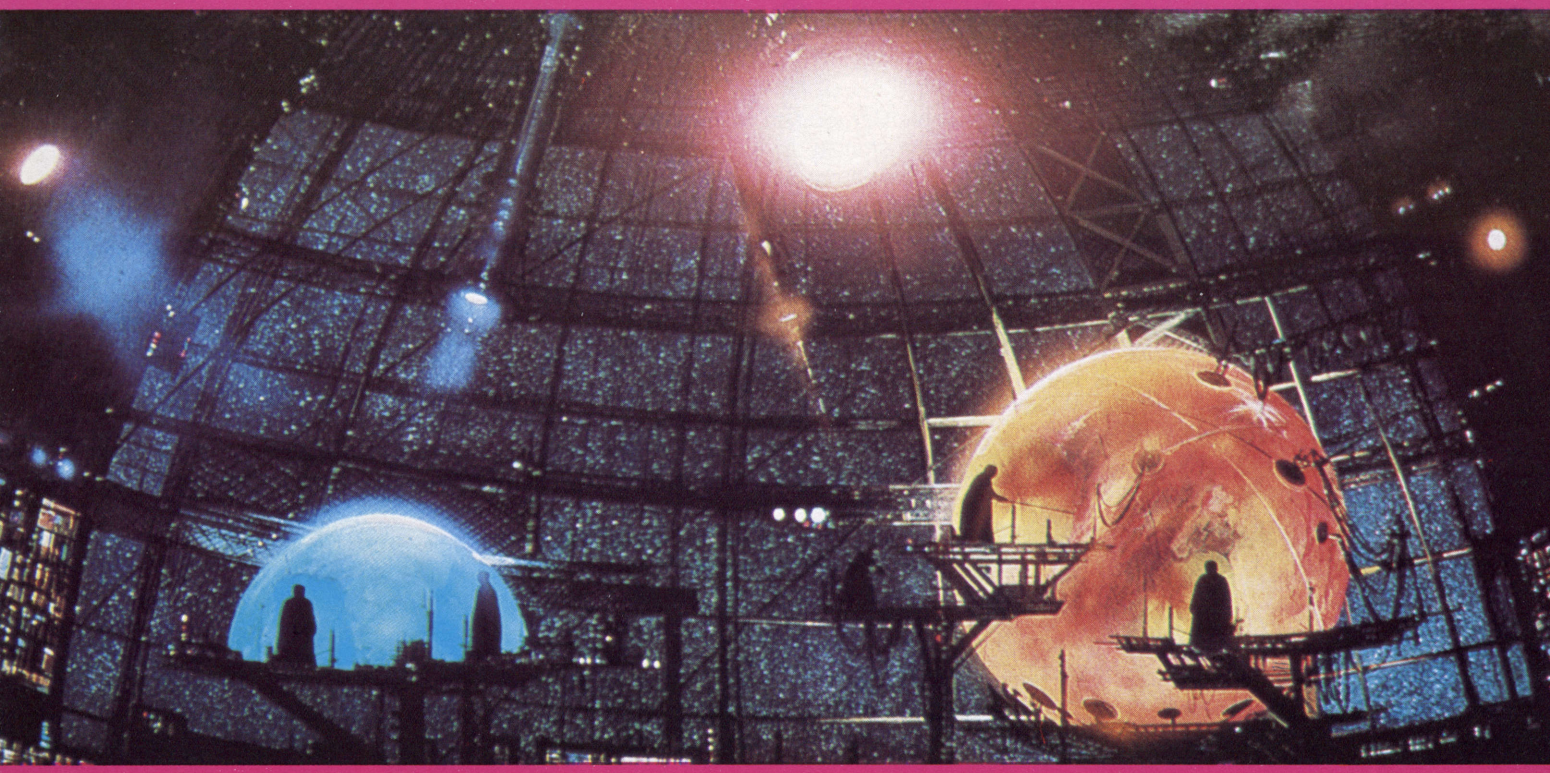




One of the many stunning optically composited scenes that appear in THE BLACK HOLE. Movement of the actors in the foreground is, of course, full-scale live action, photographed against a blue screen. The background, showing a meteorite roaring through the main corridor of the Cygnus is a miniature. The two are blended by highly skilled optical printing. (BELOW) Live action in the foreground of this scene in the Command Module of the Cygnus has been composited with a miniature of the Black Hole, seen in the background.



(LEFT) Peter Ellenshaw's color design sketch for the Astronomy Module aboard the U.S.S. Cygnus. (RIGHT) Sketch of the same set as it will look when the spacecraft is under attack by a shower of meteorites. (BELOW) The scene as it finally appears on the screen, a fine example of the art of composite optical printing. THE BLACK HOLE is noteworthy, not only for its entertainment value, but because of the extremely sophisticated effects and techniques involved in its production.



QUESTION: Why did you use blue screens rather than sodium lighting?

LYCETT: The main reason is the anamorphic process. (THE BLACK HOLE was filmed in 35mm Technovision.) The sodium camera requires a lens system in which light goes through a prism behind the lens. We would have to design a special set of lenses to handle the anamorphic process. And the blue screen format has become so improved that it's not much of a problem to stick with blue screening.

QUESTION: What film stock did you use?

LYCETT: We used the 5247 stock, which is particularly good for duping. With film stocks now you can hardly tell the difference between the dupe and the original. And we have this color reversal internegative . . . you can make a negative from the original negative, which enables you to do things with less loss of quality.

QUESTION: Did you use 5247 for all the footage?

LYCETT: For the blue screen shots we duped from separation negatives to 5247. For the laser shots we used a color intermediate duping stock, 5243.

QUESTION: Is film stock the primary reason for the improvement in the blue screen format?

LYCETT: We've made a number of improvements here in the methods of making the mattes. We feel that they've given us quite an advantage.

QUESTION: What improvements?

LYCETT: Oh, they're very technical.

QUESTION: This is a technical magazine.

LYCETT: (laughs) Oh, we'd kind of like to keep it to ourselves. Every optical house has its pet method. When I say we've improved, I mean that we've ironed out a few bugs and we're having much less trouble with matte lines.

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NEW FELLOWS DESIGNATED BY SMPTE

The Society of Motion Picture and Television Engineers honors thirteen outstanding colleagues with the distinguished grade of Fellow Member

The Board of Governors of the Society of Motion Picture and Television Engineers, upon the recommendation of the Fellow Membership Award Committee, under the Chairmanship of William D. Hedden, Calvin Communications, has conferred the distinguished grade of Fellow Member upon the following individuals.

The Fellow Awards were presented by SMPTE President Robert M. Smith at a Fellows' Luncheon held on Wednesday, October 24, during the Society's 121st Technical Conference and Equipment Exhibit at the Century Plaza Hotel, Los Angeles, October 21, to October 26.

A Fellow of the Society is one who is no less than 30 years of age and who has, by his proficiency and contributions, attained an outstanding rank among engineers or executives of the motion picture, television or related industries. Those upon whom this honor has been conferred are:

ALBERT ARBEENY, Vice President of Color Analysis and Simulation Product Line, Hazeltine Corporation, has been active in the industry since 1953. From then until 1956 he participated in color decoding techniques for color television systems and projection television receivers. He later became involved in the initial design and installation of the Hazeltine Color Film Analyzer and is now updating color film analyzers to meet motion picture needs. He is a member of BKSTS, Gravure Technical Association; Association of Cinema & Video Laboratories and Research Engineering Council for the Graphic Arts.

RICHARD W. BAUER, Technical Association, Eastman Kodak Co., in the Photographic Technology Division. He has developed magnetic dispersion formulations and led the development program for prestriped motion picture film from 1960-68 and in 1967 he developed a photographic sound process for silver sound tracks on Ektachrome films. For several years he was development project leader of sound technology and then group leader Motion Picture Pilot Laboratory. He is presently responsible for the development of films and processes for Eastman Color, including sound and television applications.

JOHN F. X. BROWNE, President, Browne Associates, Inc., of Bloomfield Hills, Michigan. Mr. Browne is a registered Professional Engineer and has had a consulting practice in engineering since 1966, specializing in Radio/Television Broadcast engineering. Prior to starting his own business he was Chief Engineer of Detroit Public Television (WTVS). He is President of Association of Federal Communications Consulting Engineers; Member of the Michigan Society of Professional Engineers (Chairman of the Ethics Committee, and member of National Ethical Practices Committee); as well as a member of Engineering Society of Detroit, Society of Broadcast Engineers, American Arbitration Association and the National Society of Professional Engineers.

SAMUEL H. BUNCHEZ, President, Vacuumate Corporation, is involved with the preservation treatment of photographic films, treatment and cartridging of endless loop films and rejuvenation of badly shrunken films, Mr. Bunchez holds a number of patents in the United States and in foreign countries relating to film preservation treatment, a slippage treatment for endless loop and cartridge films and also for a method of dimensional restoration of badly shrunken films. He is an active member of the Association of Cinema/Video Laboratories, BKSTS, PMA and NAVA.

HERBERT J. FIX, Director of Institut Fuer Fundfunktechnik GmbH, Munich, Germany. Mr. Fix was with the Rundfunk-Technisches Institut at Nuremberg from 1949 to 1956 and since 1957 has been with the present company. He is head of the research and developmental institute for the German broadcasting organizations (television and radio) as well as an author of a number of technical papers. Mr. Fix is a member of the Executive Board of Fernesh- und Kino-Technische Gesellschaft (FKTG) and a member of the program committee of the Montreux Symposium.

M. CARLOS KENNEDY, Ampex Corp., is currently responsible for product planning for the Audio-Video Systems Division. He was instrumental in bringing the Ampex VPR-series One-Inch Helical Recorders to life and has been involved with the Ampex Helical Video Recorders since joining Ampex. Mr. Kennedy has been extremely active in television standards work in EIA, SMPTE, NCTA, IEC and ITA. He is currently a member of the ITA Video Advisory Committee, the SMPTE Committee on Video Recording and Reproducing Technology and Chairman of the SMPTE Working Group in Video Test Materials and the IEC SC60C Educational Recording Systems Committee. He is also a member of the AES Digital Standards Committee.

DENNIS J. KIMBLEY, Kodak Ltd., in England, was from 1950 to 1966 the film-coating technician responsible for the development and production of motion picture products for Kodak Ltd. and was particularly concerned with improving the scratch susceptibility of motion picture films and controlling static on those products. He is presently Manager of Motion Picture Sales and Technical Service at Kodak Ltd. Mr. Kimbley is the immediate past president of the British Kinematograph Sound and Television Society and an Honorary Fellow of the BKSTS. In 1979 he was the recipient of the Interkamera International Award (Czechoslovakia).

BORIS N. KONOPLEV, Technical Director of Mosfilm Studios in Moscow, USSR, and holds a chair in the Cinema Institute in the rank of professor. Since 1929 he has been working in engineering branches of the Soviet motion picture industry and reading lectures on cinema technology in the All-Union State Cinema Institute. He is the author of six books on film production technology and of more than 100 articles in Soviet and foreign scientific and technical magazines and in Big Soviet Encyclopaedia editions. He is Chairman of the motion picture technology committee and a member of the Board of Governors at Film-Makers Association of the USSR. He is also Vice-President of UNIATEC. Mr. Konoplev has received the Soviet Prize Laureate, Honored Scientist, bearer of four Orders and Medals of the USSR and several international awards.

ANDREW KUFLUK, Professor, Broadcast Technology, Radio and Television Arts Department, Ryerson Polytechnical Institute, Toronto, Canada, has dedicated his whole career to providing the future men and women to maintain the television industry. A large proportion of Canadian television technicians, VTR operators, cameramen, lighting and sound men, come from the course taught at Ryerson by Mr. Kufluk. His contribution to the Canadian television industry during his teaching career, which began in 1946, is considerable. Thousands of young men and women in the industry, and the industry itself, owe a great deal to

him for his work in training and the encouragement given to these people. Mr. Kufluk has been the contributor of articles at various conferences and has written course texts in audio, television and film for Ryerson students.

DAVID W. SAMUELSON, Technical Director, Samuelson Film Service, Ltd., London, England. He was formerly a newsreel cameraman with Movietone News and later a freelance cameraman for Cinema, Television and Documentary type films. Mr. Samuelson is known for his development work in motion picture camera mountings, camera optics and specialized operational equipment for aerial and sea photography. He has also specialized in extreme long focus cinematography, particularly at sporting events such as the Olympics. "Motion Picture Camera and Lighting Equipment" and "Motion Picture Camera Techniques" are two of the manuals he has written, as well as many articles in the BKSTS Journal and *American Cinematographer.* Mr. Samuelson is a past president of the BKSTS; Vice-President of UNIATEC; Chairman of the Incorporated Association of Kinematograph Manufacturers; and Governor of the British Society of Cinematographers.

ARTHUR C. SMITH, Director, Smith & Cross Pty. Ltd., Bronte, N.S.W., Australia, first became interested in the recording of sound for films in 1929, when it was still in the experimental stage on his side of the world. From 1931 until 1958 he was Chief Recording Engineer for Cinesound Productions Pty. Ltd., and during this time also formed Smith & Cross Pty. Ltd. to manufacture sound film equipment. Mr. Smith's experimentation with improving methods of sound recording have gone from recordings made with a tungsten arc discharge tube, to using a mercury vapour discharge tube, with a new design of optical system to suit the recording tube. With the development of group noise reduction in the States, Smith successfully applied the idea to his glow tube recorder. In the fifties a paper appeared in the Journal of the B.K.S. saying that a method has been developed for applying noise reduction to glow tube recordings. Arthur Smith had done that in 1933. Throughout his career, he has always been the innovator in producing up-to-date sound recording equipment, and at the age of 77 is now keeping up with the new digital integrated circuits that are being used in the industry.

RICHARD G. STREETER, Director, Advanced Development, CBS Television Network, has been, since the early 1960's, the principal engineer for CBS Television Network Engineering and Development on the advanced development of improved, more compact, color television cameras. He participated in the development and very first use of Plumbicon-type color cameras which soon became standard in the industry. His work as project manager for the development of the CBS Minicam, won an Emmy Award in 1969 in recognition of its importance as the first full-quality, hand-held camera. Mr. Streeter was responsible for development and application of cameras and portable video tape recorders in the pioneering of Electronic News Gathering. His other projects have included participation in the development of the color corrector, digital noise reducer, and other sophisticated electronic hardware widely used today.

HARUO TESHI, Managing Director, Elmo Company Ltd., Japan, is truly outstanding in his forward thinking and willingness to enter into untried markets with progressive technology. He has also recognized the importance of standardization and has devoted many years of service to effective international representation in our discipline. Mr. Teshi is presently involved in the development of equipments and systems in the motion picture and related fields. His patents include a small-sized cinematographic camera device; a small-sized motion picture projector, plus 46 other patents and 28 utility models. Mr. Teshi is an Expert with the ISO/TC-36/PWG-5 and also Chairman, TC, Japan Motion Picture Equipment Industrial Association. ■

AUTOMATIC CAMERA EFFECTS SYSTEM

Continued from Page 61

The ACES mount supports the camera and provides the following performance:

AXIS	TRAVEL	POSITIONING ACCURACY	SLEW-RATE
Pan	360°	.01 degrees	36 degrees/second
Tilt	360°	.01 degrees	36 degrees/second
Roll	720°	.01 degrees	36 degrees/second

Limit switches and software limits provide overtravel safety constraints.

The mount is attached to an extension boom which may be mounted in one of three axial locations providing straight ahead or either-side modes. In addition the mount is rotatable 180° for inverted operation.

CARRIAGE and DOLLY

The ACES Carriage and Dolly provides the following performance:

AXIS	TRAVEL	POSITIONING ACCURACY	SLEW-RATE
North-South	48"	.01 inches	6 inches/second
East-West	48"	.01 inches	6 inches/second
Truck	68 '	.01 inches	3 feet/second

Limit switch overtravel protection is similar to the mount and gimbal. In addition, an Overhead Trolley with synchronized servo drive system provides automatic cable conveyance and positioning above the carriage and dolly. A catenary loop in the multiple, multiple-conductor cables provides freedom of movement.

MODEL STAND

The ACES model stand provides the following performance:

AXIS	TRAVEL	POSITIONING ACCURACY	SLEW-RATE
Model Truck	30'	.01 inches	3 feet/second
Model Pitch	90°	.01 degrees	36 degrees/second
Model Roll	90°	.01 degrees	36 degrees/second
Model Yaw	360°	.01 degrees	36 degrees/second

Limit switch overtravel protection is similar to the camera mount and gimbal. Auxiliary hydraulic dampeners are provided to minimize oscillations which may occur within very long and flexible models during stop-motion photography.

Provisions have been made for future installation of an illuminated pylon.

PROCESS PROJECTOR

The ACES Process Projector can project single- or double-frame (4- or 8-perf. format) and is equipped with a 1600-watt Zenon lamp for a bright evenly illuminated field. Filter holders are provided for use with YCM separation masters and other specialized needs. Unique cooling techniques allow instantaneous use after film advance, practically eliminating any evidence of film 'popping'.

The local mode of operation allows rewind, advance, etc. Remote control under the ACES provides frame-per-frame, skip-framing in any ratio desired between camera turnover and projector advance (forward or reverse). A monitor point is provided the computer in the ACES mode to allow for error checking between desired program and actual operational condition. ■

"PITCHING LENS"-A UNIQUE AND VERSATILE OPTICAL RELAY SYSTEM

By ERNST (BOB) NETTMANN

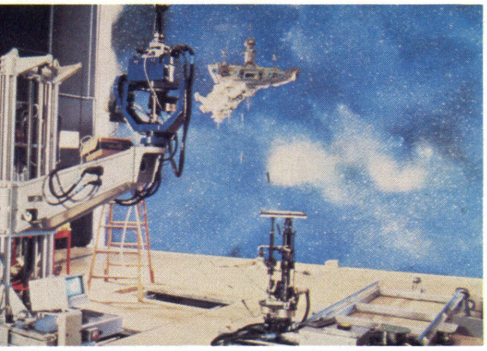
This snorkel-type optical relay system, unique in that it does not use a mirror, but tilts the entire lens, has an incredible depth of field

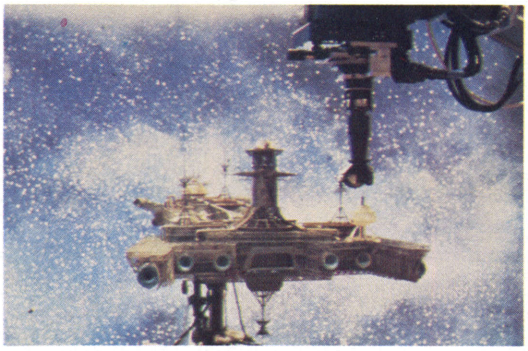
The Pitching Lens System was originally designed to become a second generation of the Academy Award-winning Astrovision System—an aircraft mounted periscope. This system and the system of our associate Paul Kenworthy (Type B) both use the concept of a tilting mirror to tilt the image up and down during the shooting.

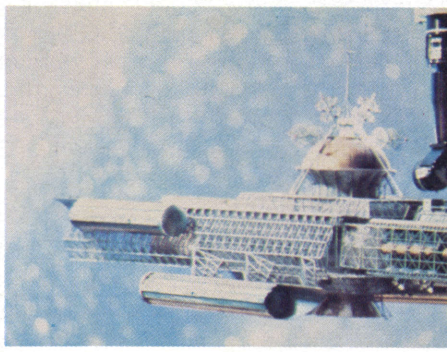
The requirement for Pitching Lens was that we be able to use Nikon or Arriflex lenses in which we would not use a mirror but, in fact, tilt the complete lens. This allowed us to shoot with much wider-angle lenses and have an optical system which was better corrected optically because of the use of the internal entrance pupil vs. the external entrance pupil, which is the case in mirror tilting systems.

In the Pitching Lens system, the lens is able to pitch 180 degrees at the end of the optical relay tube and rotate 360 degrees, and still have the image correct in the frame. Another requirement was that we have a faster system than was the case in Astrovision. Astrovision is an F/6.3 system; the Pitching Lens system is an F/3.9. This would allow us to mount the camera and relay tube in the camera plane and allow us to achieve wider-angle shots of subject aircraft or air-to-ground shots, and also enable us to shoot at lower light levels.

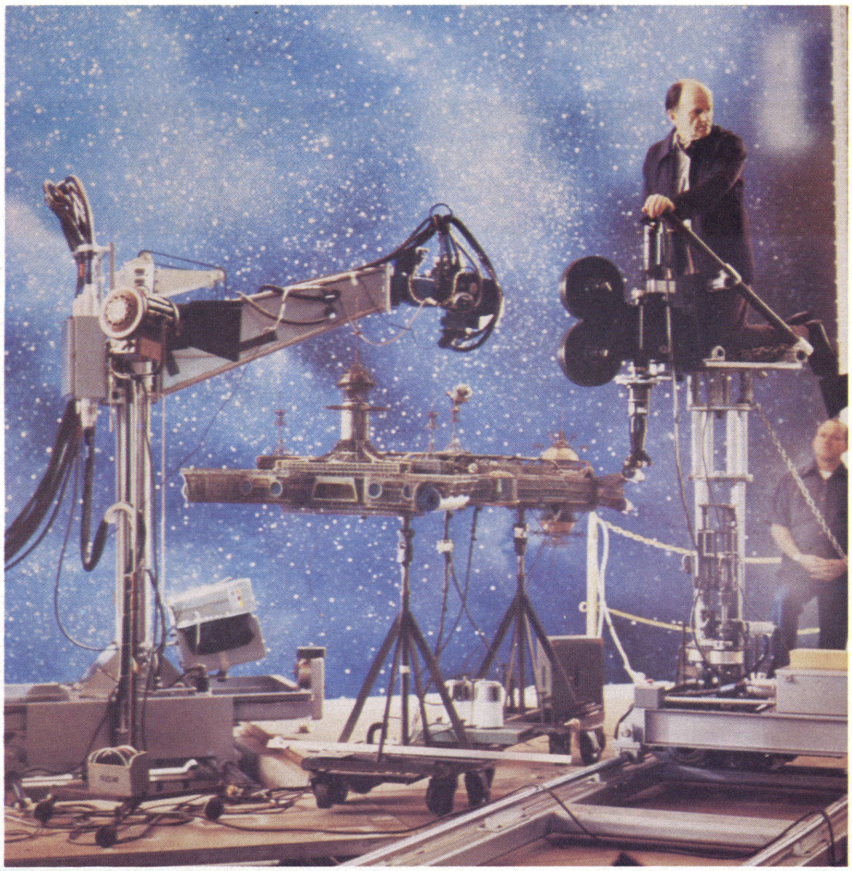
After various experiments and with the technical advice of Milton Laikin, a well-known optical designer, and with the advice of end users such as director-cameraman Ron Dexter, the Pitching Lens evolved after two years of research and development. Ironically, the system has up until now never been used in an aircraft, but has been used for the filming of table-top commercials by Paul Kenworthy and his associates and one or two other director-cameramen.

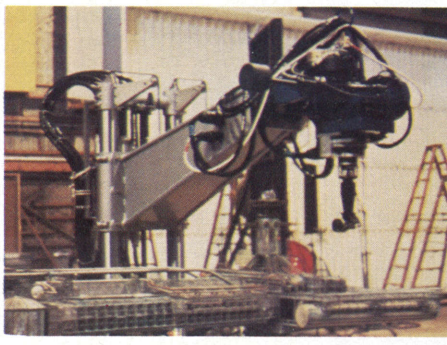


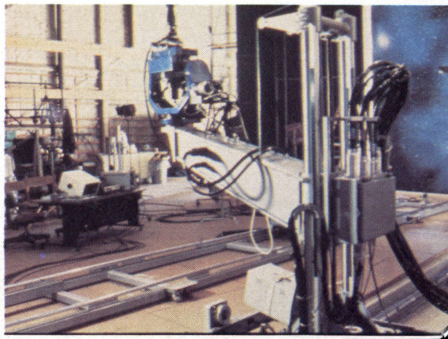




Photographs on this page show the Pitching Lens, developed by Continental Camera Systems, mounted on the ACES (Automatic Camera Effects System) crane to film a miniature of the U.S.S. Cygnus spaceship for Walt Disney's THE BLACK HOLE. The lens is able to pitch 180 degrees at the end of the optical relay tube and rotate 360 degrees, and still have the image correct in the frame. The Pitching Lens system is an f/3.9 system, considerably faster than similar optical relay systems. The product of two years of research and development, the system is extremely versatile.







In some cases the Pitching Lens system for table top work can be used to achieve a certain angle or shot, and in other cases Paul Kenworthy's Type B system (which was creatively engineered by Continental Camera Systems, Inc., and which also won an Academy Award) can be used to achieve other types of shots.

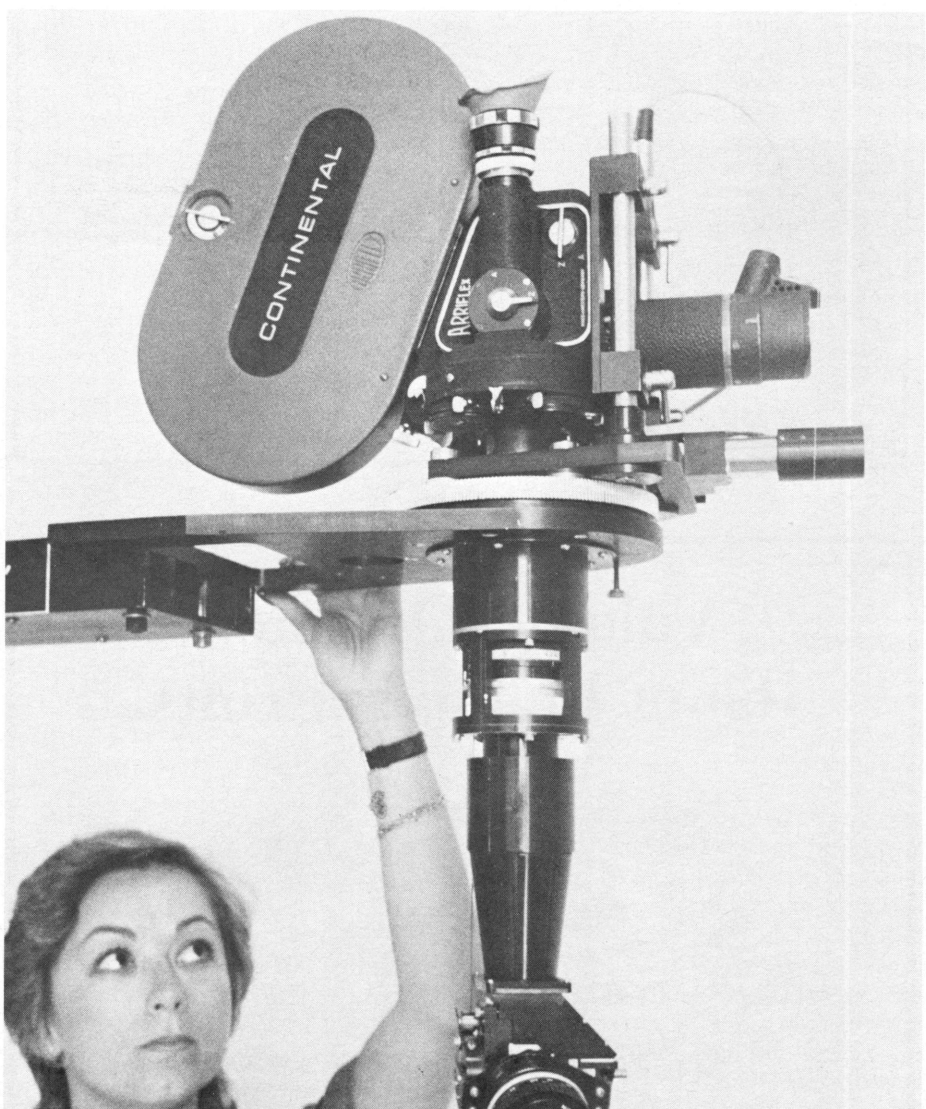
Various systems are on the market where you have an optical relay tube and a lens; usually an Arriflex lens which is set at right angles to the tube. This allows you to achieve certain angles and certain moves through products, but the uniqueness of the Pitching Lens system is that the lens at the end of the tube can now tilt through 180 degrees and allows you to achieve some very creative camera angles.

The system has been used with lenses as wide as the 8mm Nikkor and even small zoom lenses.

When Walt Disney Productions called Paul Kenworthy and ourselves in to discuss the shooting of THE BLACK HOLE, we learned that their requirements were for extremely wide angle shooting and the ability to get down into the superstructure of the space ship that they wished to film; in some cases they wished to have an optical probe where a lens mounted at the end of a horizontal optical tube could create some effects—such as going through apertures in the space ship.

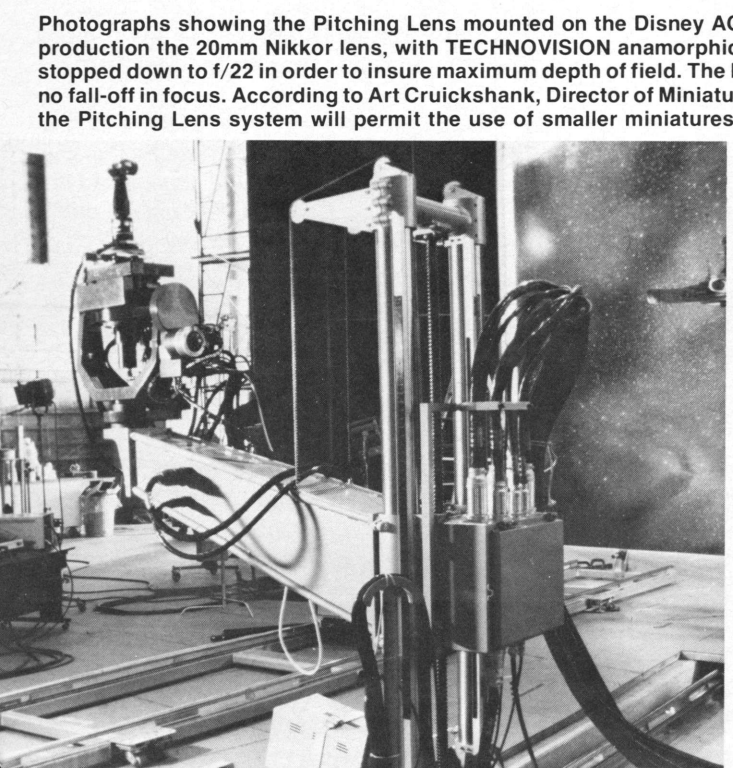
After discussions with Paul Kenworthy, his associate Bob Johnson, and my partner John Carroll, Disney elected to use the Pitching Lens system because of its wide angle capabilities and its in-line feature when they wished to use it as an optical probe. Bob Johnson, who has many years experience in shooting table top and miniatures, could best advise the production designer, Peter Ellenshaw,

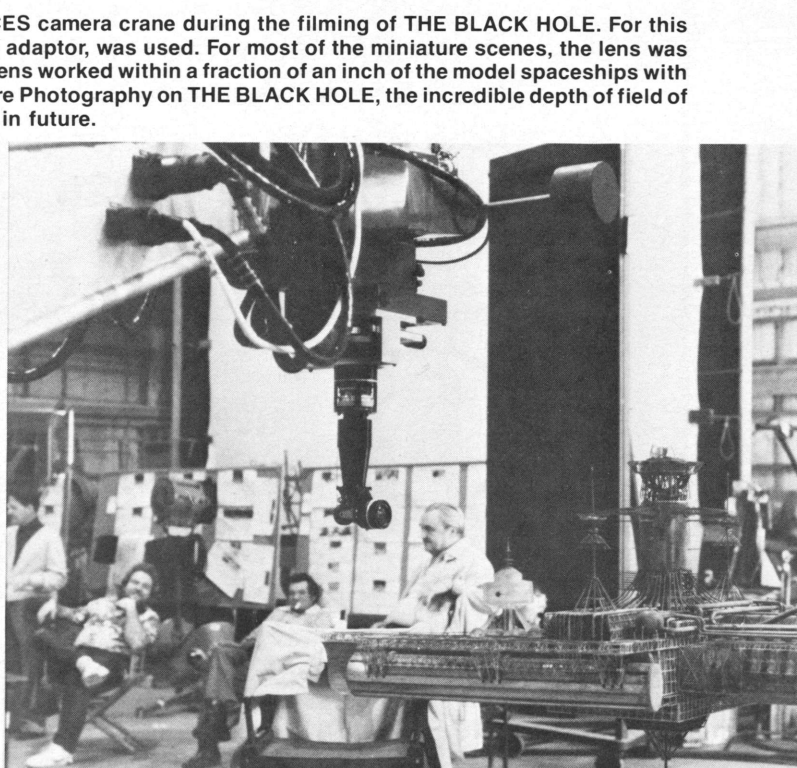
Continued on Page 86

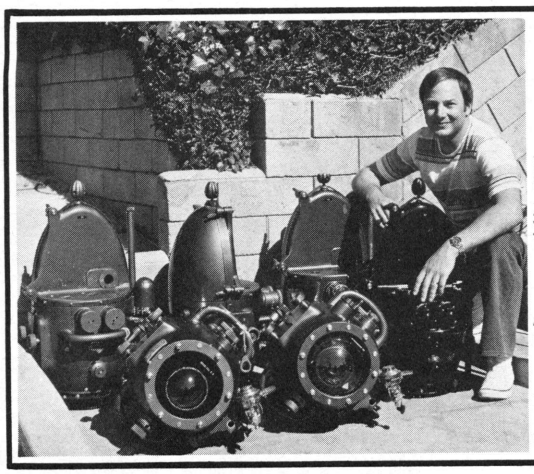


The Pitching Lens, used in conjunction with the Arriflex IIC camera. When the Nikkor 20mm lens is mounted, the system has a depth of field from one inch to infinity. It can be remotely controlled to pan 360 degrees and tilt 180 degrees. The system has been used with lenses as wide as the 8mm Nikkor and even small zoom lenses, and it accepts a wide variety of Zeiss, Nikon and Arriflex prime lenses.

Photographs showing the Pitching Lens mounted on the Disney ACES camera crane during the filming of THE BLACK HOLE. For this production the 20mm Nikkor lens, with TECHNOVISION anamorphic adaptor, was used. For most of the miniature scenes, the lens was stopped down to f/22 in order to insure maximum depth of field. The lens worked within a fraction of an inch of the model spaceships with no fall-off in focus. According to Art Cruickshank, Director of Miniature Photography on THE BLACK HOLE, the incredible depth of field of the Pitching Lens system will permit the use of smaller miniatures in future.







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FROM "SNOW WHITE"
TO "THE BLACK HOLE"
Continued from Page 79

QUESTION: You use a three-headed optical printer. Was that developed at Disney?

LYCETT: Yes, I think it was developed in 1956. It was the first three-headed printer in the industry.

QUESTION: What are its advantages?

LYCETT: Most people don't like to use three-headed printers because they've had problems with them, but ours have been real workhorses because we can put the backgrounds in the back head, the mattes in the front head and the foreground optic in the side head, and line them up with a microscope. We can do the thing in three passes instead of six, which you'd need if you were bi-packing.

QUESTION: Many of the scenes in THE BLACK HOLE have characters standing against viewports in a spaceship. How did you maintain the color balance in all the scenes filmed against "outer space"?

LYCETT: It depends a lot on the scene . . . there are so many tiny variables in the processing that can make the color drift on you. There was always somebody from the (optical) department on hand when an effects scene was filmed. We keep a log of every scene and every take—whether it's printed or not. That's proved a lifesaver once in a while. A real hazard that we face is putting the negative through the printer—to make masters and mattes—so many times. You have to watch out for a mis-thread or a crack-up because you can ruin an original negative. That's where the sweaty palms come in.

QUESTION: Did you have any trouble holding the color on the star field?

LYCETT: Not really. That was primarily a matter of controlling the contrast in the masters. Of course our star field isn't really black, it's more dark blue in color, so we had to be careful that it didn't go to grey.

QUESTION: The Cygnus, which is the large spacecraft in THE BLACK HOLE, is built with a lot of intricate detail. Did that pose any problems for you?

LYCETT: When we saw the design of the Cygnus, we were horrified with all those details. Fortunately, in most cases, the Cygnus is against a star background. If we had to shoot that against a day sky, I

think we'd be in trouble. We had to shoot a lot of steam and smoke, which normally give you trouble against a blue screen, but we were able to overcome that too.

QUESTION: How?

LYCETT: It's a question of controlling the density of the cover matte. The blue screen area never has quite enough density in it to keep out the light that you don't want to come through, so we have to bi-pack that with a cover matte, a partial-density matte to supplement the density of the sky. Well, you can't get the cover matte too heavy or it'll close in; and if it's too light it'll leak. A very delicate deal.

QUESTION: 42 years in the business—has THE BLACK HOLE been your biggest challenge?

LYCETT: I would say it has, because of the quantity of work, and the time frame we've had to work with. For the last nine months my department—about 25 people—has been 100% on THE BLACK HOLE. Make that 98%. We've handled a few things that have trickled through.

QUESTION: Where are the new Eustace Lycetts coming from?

LYCETT: Right here in the department at Disney. There's potential here. Given a chance these people would come through.

QUESTION: And what will be the developments in special effects photography in the coming years?

LYCETT: It's always difficult to look ahead, but looming on the horizon are the electronic systems. I think in a few years time we'll be combining opticals electronically, and it'll be a whole new ball of wax. The basic principles will remain, but the systems for making the mattes and the YCM masters will be electronic. You'll go from film, through an electronic system, and back to film. The technology is there, it's just a question of somebody getting down, putting the money in, and building it. Frank Van der Veer and Pete Vlahos are two I know of who are forerunners in electronic composite printers.

QUESTION: One last question, Eustace: What do you do to get the sweat off your palms?

LYCETT: Play golf. (Mr. Lycett volunteered his handicap which, in the interest of charity, has been stricken from the record.) ■

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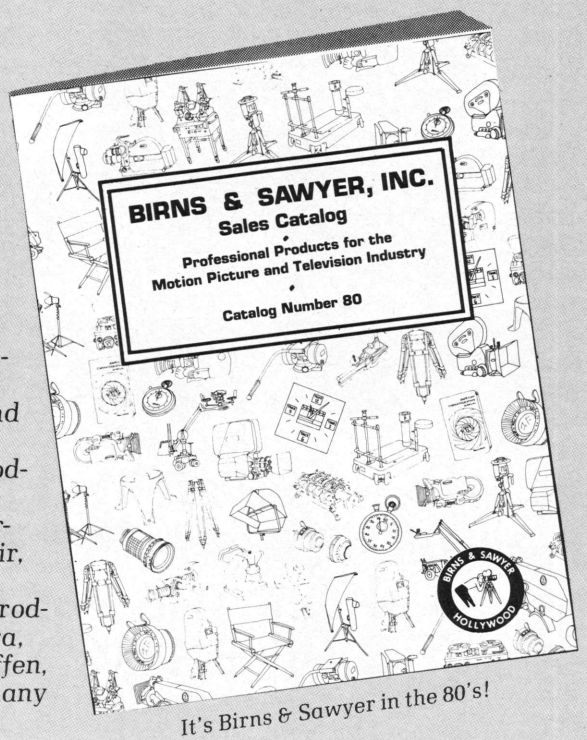

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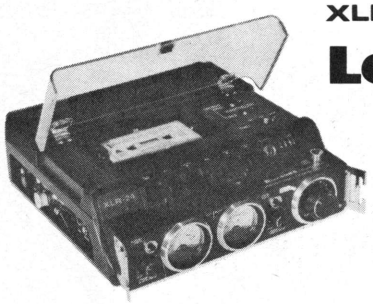

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PITCHING LENS SYSTEM
Continued from Page 83

and the special effects cameraman, Art Cruickshank, to achieve the maximum capabilities of this unique optical system. Bob Johnson was, therefore, hired for the full nine months' shooting of THE BLACK HOLE miniatures.

Prior to the acceptance tests by Disney of the system, we had made our own tests of depth of field and resolution using F/9.8 Tegea and an anamorphic element mounted between the end of the tube and the camera; we were able to achieve the equivalent of a 19mm anamorphic lens with no distortion, and depths of field far greater than that of a prime anamorphic lens.

For instance, the depth of field at F/16 on this system resulted in a depth from one inch to infinity and later, in subsequent experiments with Disney, we found that with a 20mm Nikkor lens mounted on the front of the tube and an anamorphic element at the rear, we could achieve for a 40mm anamorphic, a depth of field from two inches to infinity, again when the main relay was set at F/16. Since focus is accomplished in the relay tube, the system can follow focus continuously, at any aperture, from a 1" field out to infinity.

Very early on in the shooting of THE BLACK HOLE, Disney discovered that depths of field with the Pitching Lens were completely out of the range of the standard depth of field charts that had been in use for many years. The author had, as a requirement, always wanted to achieve something different to what was in existence and, with the help of Milton Laikin, we have indeed achieved that.

Since our first feature movie with the Pitching Lens we have worked on the movie METEOR with the company called "Motion Pictures Inc." and are presently working with the Apogee company on the movie STAR TREK. In this movie we are filming in a VistaVision format. At present, the writer is developing an even more unique optical system for use on Disney Productions ACES camera system. This will be a multiple format optical relay. The formats required by Disney are Academy, anamorphic Academy, VistaVision, Technirama and 65mm. ■

CONTINENTAL CAMERA SYSTEMS PITCHING LENS—SPECIFICATIONS

This *snorkel-like camera system* is small and compact—ideal for shipping and location shooting. You may use a locally available dolly and shoot in your local studio, outside, or location interior. Because of fast, prime lenses (at the end of the optical tube), the equipment can

shoot at low light levels in locations such as stores and restaurants without a large amount of supplemental lighting. Wide angle lenses may be used.

With the addition of this finely engineered camera unit, there is now available a full range of optical relay camera systems—systems to expand the capabilities of the normal, non-remote film or tape camera. Please note the specifications of the PITCHING LENS below:

Optical: Wide variety of Zeiss, Nikon and Arri prime lenses are usable, including short lenses such as the 16mm Zeiss Distagon and the 20mm Nikkor. Maximum speed of the optical system is f/3.9, requiring 100 foot candles at ASA 200 with Type 5247. Minimum focusing distance with 16mm lens: 1/4 in.

Tilting Range of Lens: From horizontal (0°) viewpoint to straight down (90°). Lens can also continue moving an additional 90° backwards to achieve upside down viewpoint. Lens does not tilt up past horizontal angle.

Panning Range: 360° with successive revolutions possible.

Cameras: 35mm Arriflex 2C; 16mm Arriflex M; Norelco PCP 90 tape camera; VistaVision.

Suspension: Elemack, Sidewinder, Fisher or similar dolly. A boom arm is required. Client may supply Elemack mini-jib for Elemack Dolly, or Continental Camera Systems can ship you a boom arm. Note cost below.

Power Requirements: Versatile. 24 V DC, or 115 V AC, or 220 V AC.

Additional Equipment: Servo motors with remote electronic controls for panning, tilting and focus. One console with two monitors, pressure type joy-stick control for pan-tilt. Closed-circuit black and white TV camera shows accurate reflexed view of scene. Special swivel at end of boom arm provides wide range of lens movement without having to move dolly. Spare parts supplied.

Optional VTR for instant dailies.

Crew: Minimum of one operator/technician from Los Angeles required. During shooting an operator and focus man at the console, and a grip at the end of the boom are required.

Shipping Weight: Without boom arm: 260 lbs. including cases. Boom arm, if required, weighs 140 lbs., case included. VTR weighs 125 lbs.

Prices per Day: Pitching Lens System for filming: $1050.00. Without camera and CCTV for shooting tape: $1000.00. Each prime lens: $10.00. Boom arm: $70.00. Minimum of two days rental for out-of-town use. ■

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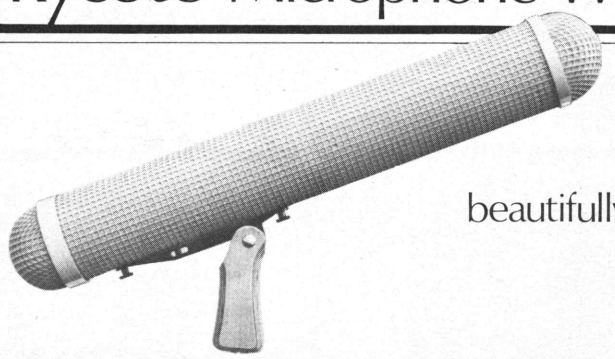

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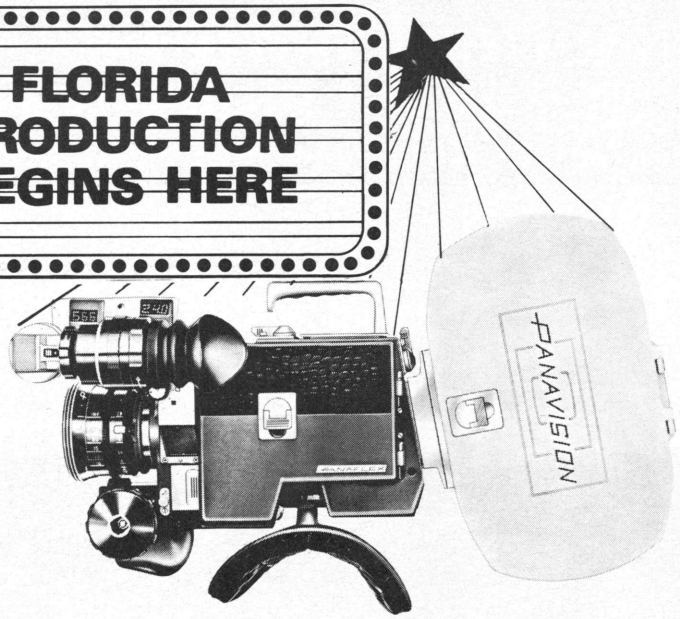

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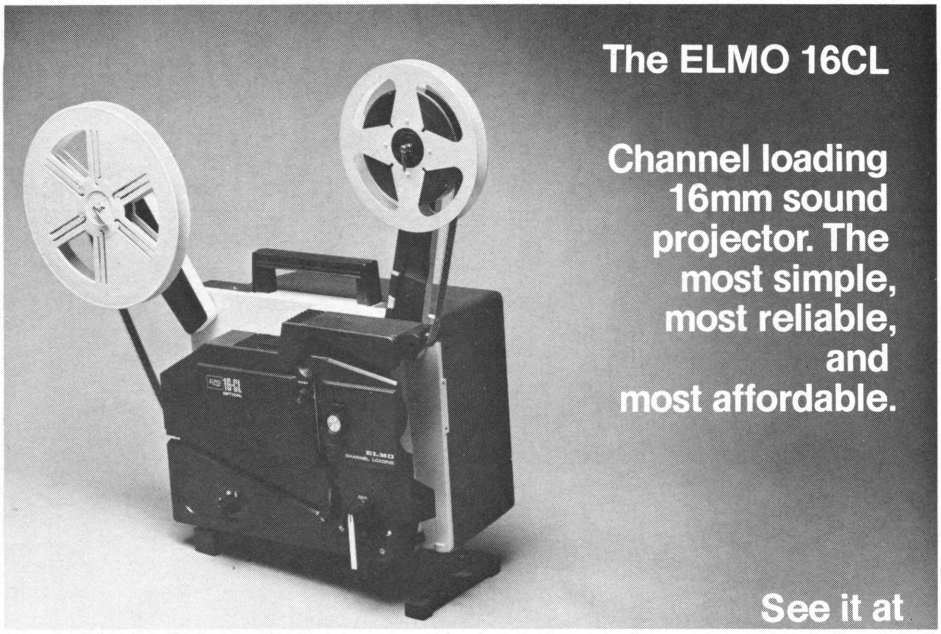

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Continued from Page 70

then the third frame for the following three frames, etc. The second time we exposed the first frame for three frames, then the second frame for three frames, the same pattern, only slipped two frames. The result was one pure frame, then two frames of cross dissolve, then a new pure frame. Amazingly enough, though I didn't think it would work, it did. It was David Mattingly's idea and it gave the whole thing more scale.

We rear projected that and added a painting of the stars. On the edges, there were three other burn-ins, white painted on black velvet and projected with color filters. The end result, to make the black hole plate, consisted of separation masters of the black hole, cross dissolved, burn-ins, the painting and even a little diffusion on the outside of the black so it is soft and moving. Eight elements all together.

QUESTION: Did you do that for each black hole?

HARRISON: We used it as a completed plate in some cases. It was photographed in VistaVision. We made separation masters from that. It is another generation, but the quality held up quite well.

There were times where we couldn't do that, we had to get a closer shot. Then we would go through the process all over again from a different position. That accounted for a large number of matte shots.

QUESTION: When the picture was first planned, you were going to use front projection and rear screen projection with separation masters . . .

HARRISON: There were thoughts that on the stage with ACES we could rear project. In the matte room, we do this on a screen about 1½ by 3 feet. We thought we could apply this to model photography on a stage and get the same kind of quality.

Rear screen projection has a lot of inherent difficulties, mainly hot spots and grain. We felt you can eliminate the hot spot by carefully working out the optics on the lamp and projection lens elements. Also, you generally get the hot spot because you're pumping in so much light. Well, with long exposures you don't need that amount of light. We thought we could eliminate the grain by using separation masters. We did that in a couple of cases, but we ended up

using another method which was a little faster. We front projected onto a painted star background with the front projection as a separate exposure.

Also, the black hole was added optically. You shoot the entire thing, the model in front of the stars, and then pull the stars out and whip in a white background, take the light off the model and shoot the matte for the black hole. ACES repeats the move exactly. Then put them together optically in the lab. Art Cruickshank and Eustace Lycett were responsible for that, it really has nothing to do with matte shots.

QUESTION: But you use rear projection in the matte room, don't you?

HARRISON: Since 1960. Before that we used original negative and bipack. Rear projection was introduced by Ub Iwerks. He and Eustace Lycett came up with the idea of using separation masters. It's been refined over the years. We shoot all our plates in VistaVision through Leica still lenses. We can take those plates, rear project them and maintain quality comparable to production. That is very important, because a matte shot gives itself away if it appears on the screen looking dupey.

Rear screen has two great advantages. First, you can recompose the plate, make it smaller, put it in different areas. It gives you a great deal of flexibility. It's great for people who are indecisive. Second, you can use more than one plate; i.e. have more than one piece of action in the matte or use additional still plates. You have to be careful with stills though, especially with grain. When we use one, we photograph it with a 35mm Leicaflex which gives a VistaVision frame that will work on our projector.

QUESTION: Does rear projection make it easier for you to use MatteSCAN?

HARRISON: MatteSCAN (Matte Specialized Camera Automated and Numerical) is the name we gave our motion-control camera stand. I am extremely happy with its success. It moves along three axes: in and out, which gives you the action of a zoom; up and down and sideways. There is also focus. The value comes from its ability to precisely repeat each move.

Since we expose each element separately, a simple matte of one plate and a painting means four exposures. Therefore, if you want a move in the finished product, say a slight east-west drift across the painting including the plate, you must repeat that move exactly all four

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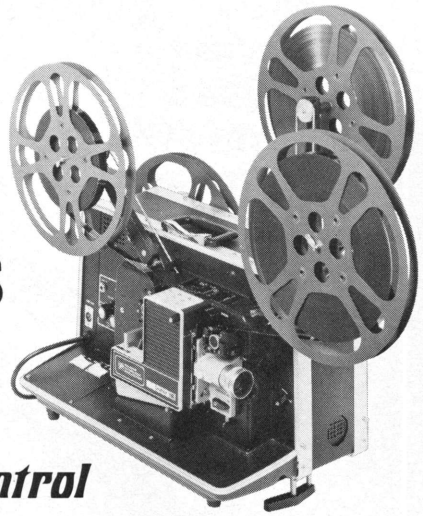

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times. It has been done before, but by hand.

Combine it with rear projection and the possibilities for complications increase. For example, a fairly complex shot is the observatory. In the film, it is the first look the audience and the heroes of the film have of the interior of the command tower in the spaceship Cygnus. They take an elevator that leads them to the top of a tower. At this point, the elevator doors open and they walk out onto a set/matte. The camera follows them out, then we pull back and tilt up. We have action in the middle, humanoids on the sides and also humanoids in the readout observatory discs. There are seven plates all together. Our cameraman, Ed Sekac, was a tremendous help. He has years of experience with cameras and film, but programming a computer to run the camera stand was all new to him. He picked it up very quickly and was able to program moves that were perfect the first time.

QUESTION: Was there a time problem with so many mattes?

HARRISON: The problem wasn't so much to paint them, but to get them shot. It takes about one second of exposure and two seconds of turnover for each frame, each element. There was a great deal of painting, but it is not highly finished because the film is capable of resolving only so much.

Basically, the success of a matte shot breaks down to composition and tone values. If the tone values are right and the composition is right, the eye accepts it as reality. You want a painting that looks like reality—you can never be better than reality, you can only equal it—you don't want a painting that looks like a painting. The big problem with painted matte shots is that the only ones that people notice are the ones that aren't any good.

QUESTION: How many are you going to get by with in this picture?

HARRISON: Generally, if we can achieve complete believability 80% of the time, we're doing well; 90%, very well. With 150 matte shots, 10% is 15 mattes. That's more than I've done in a lot of pictures. It would be a killer. So we have shot for 100% good.

Luckily, we've had the cooperation of the director, Gary Nelson, the director of special effects, Peter Ellenshaw, and producer Ron Miller. We have agreed that if there is anything that doesn't work, we just won't use it. We will work around it. So far, we haven't had to compromise often, but there have been shots that literally would not work.

QUESTION: Gary Nelson worked closely with you on the mattes?

HARRISON: Gary was one of the most pleasant and competent directors I have ever worked with. Without him, I never would have been able to complete the matte shots in time. He has an excellent visual sense, which is something not everyone has. He can imagine something that won't be added until post-production. We were able to get early decisions which eliminated a lot of uncessary work. It can be very frustrating to work on a shot only to find that it is cut out of the picture two weeks before your negative cut date. This has happened too frequently before.

QUESTION: Do you use special stocks for your work?

HARRISON: We used 5247 for all our raw stock. We overexposed it one-half to a full stop for the original plate on the set. That gives us better dupes with separations. We also use it to photograph the mattes. An advantage is that it times the same way everything else does. With 5247, the blacks are nice if you overexpose half a stop and print down. We planned that for the entire picture.

QUESTION: I understand that Disney maintains a large matte department?

HARRISON: We have three artists, David Mattingly, Deno Ganakes and myself, two projectionists, Don Henry and Andy Henry, and two cameramen, Ed Sekac and Artie Miller. This way we can use the equipment 16 hours a day. In these days, it is rare that you have a matte department in a large studio. All the majors used to have them. Now, it is us and Universal.

QUESTION: Some people are saying that THE BLACK HOLE is going to be the effects picture . . .

HARRISON: Did I say that? Effects are only icing on the cake. They never make a picture. I think generally, that Kubrick achieved the benchmark with 2001, A SPACE ODYSSEY. He had time, money and more important, himself. The singlemindedness to know what he wanted. Lucas in STAR WARS didn't have the time, but he had the singlemindedness. That made for a lot of compromises; but he had so many good elements that he still achieved success. Gary Nelson knows what he wants and demands it. After that, it is up to the public. ■

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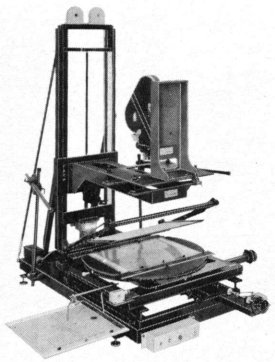

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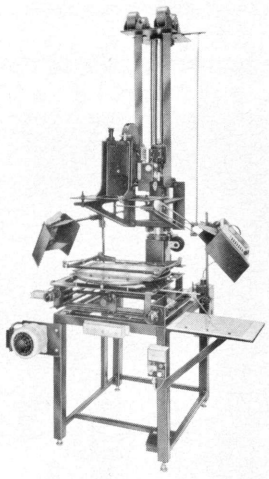

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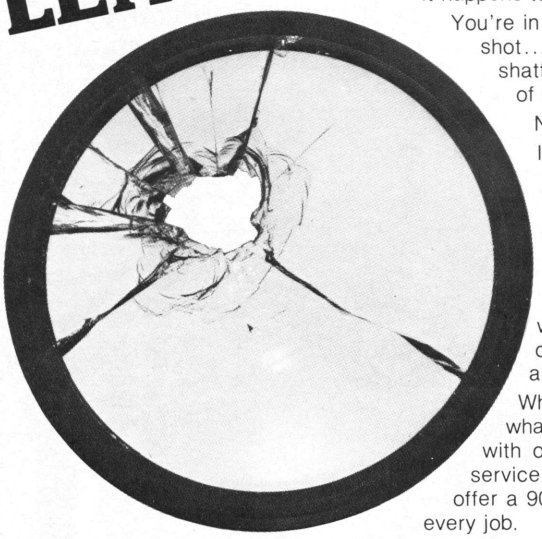

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BEHIND THE SCENES OF "THE BLACK HOLE"

Continued from Page 26

BROOMSTICKS and is head of the studio's special photographic effects department. Cruickshank, department manager of the studio's photographic process lab, won an Academy Award in 1967 for FANTASTIC VOYAGE.

Lee, who won an Academy Award in 1971 for BEDKNOBS AND BROOMSTICKS, is head of the studio's mechanical special effects department.

Frank Phillips, A.S.C., was Director of Photography.

Harrison Ellenshaw, whose credits include STAR WARS, THE MAN WHO FELL TO EARTH, BIG WEDNESDAY and Disney's PETE'S DRAGON, headed the matte artists. He employed four artists, more than half of those now in Hollywood, to help on THE BLACK HOLE. Ellenshaw said there were 13 matte paintings used in STAR WARS and in THE BLACK HOLE there are 158.

Oscar-winning composer John Barry wrote the score for the film. Barry, who won an Academy Award in 1968 for THE LION IN WINTER, wrote the scores for KING KONG, DAY OF THE LOCUST, BORN FREE, MIDNIGHT COWBOY, and eight James Bond films, FROM RUSSIA WITH LOVE, DR. NO, ON HER MAJESTY'S SECRET SERVICE, GOLDFINGER, THUNDERBALL, YOU ONLY LIVE TWICE, DIAMONDS ARE FOREVER and MOONRAKER.

Academy Award-winner Bill Thomas designed costumes for the human actors. Thomas, who has been nominated 11 times for Oscars, won the award in 1961 for SPARTACUS.

Robert J. Schiffer, head of the studio's makeup department, designed makeup and hair styles. Two-time Oscar nominee John Mansbridge, supervising art director and head of set decoration and property departments, was art director on the film, along with assistant Al Roelofs.

George McGinnis of WED Enterprises, a Disney subsidiary, designed the non-human characters and their wardrobes.

In 70mm "Technovision" and color by Technicolor, THE BLACK HOLE screenplay was written by Jeb Rosebrook and Gerry Day from a story by Jeb Rosebrook and Bob Barbash & Richard Landau. Buena Vista releases.

WHAT ARE THEY?

Imagine yourself seated in outer space. In the distance are bright pinpoints of light--the stars. And farther away, the vast wispy collections of stars called galaxies.

Before you is empty space and in it is a

round ball of nothing. Nothing so complete it is not even space. It is a Black Hole. Its edge is where space and time end. Anything that passes that point enters a universe of the complete unknown—oblivion.

An amazing conception? Not so, according to the most recent theories of astronomers. Black Holes exist, they say, though man finds it difficult to prove with facts and figures. They are the grave markers of dead stars.

A star is a vast collection of gas. It is held together by gravity. While young, the star is hot and the gases react like a gigantic hydrogen bomb explosion. The heat from these fusion reactions acts like girders in a building and give the star its shape. But when the gas runs out, after millions of years of burning, gravity takes over. The girders disappear, the star collapses and contracts, becoming smaller and denser. The gravity increases. Finally, a point is reached when even light, the fastest phenomenon known to man, cannot escape from the collapsing star. A Black Hole is formed.

Black Holes are a mystery even to the scientists who predict their existence. They are a place where all the carefully researched laws of physics cease to operate. On their periphery time slows and finally stops. Matter could separate and finally be annihilated, some say.

Other scientists are not so grim. They suggest that a Black Hole may be a path to a different part of our universe, or another universe altogether, a short-cut around space through an unknown dimension.

Paradoxes abound. It is conceivable to enter a Black Hole and find yourself back where you started before you began. Whole new universes may exist within their boundaries. If so, we have no idea whether or not the laws that rule our universe would rule there also. There is no reason to think they should.

One recent development in Black Hole theory has an interesting application to our own universe. It is thought that gigantic Black Holes inhabit the centers of galaxies. There, they suck into their grasp entire suns, planets and all the debris of space. If so, it is possible that, in time, the surrounding galaxy will disappear into the ever-expanding Black Hole. And after the galaxy? Some scientists theorize that a Black Hole may be the fate of the entire universe. ■

(EDITOR'S NOTE: The staff of this journal wishes to express deepest gratitude to Tom Wilhite and Chuck Richardson of Walt Disney Productions for their invaluable assistance in assembling text and visual materials for this special issue of AMERICAN CINEMATOGRAPHER. All illustrations pertaining to THE BLACK HOLE in these pages © MCMLXXIX Walt Disney Productions, World rights reserved.)

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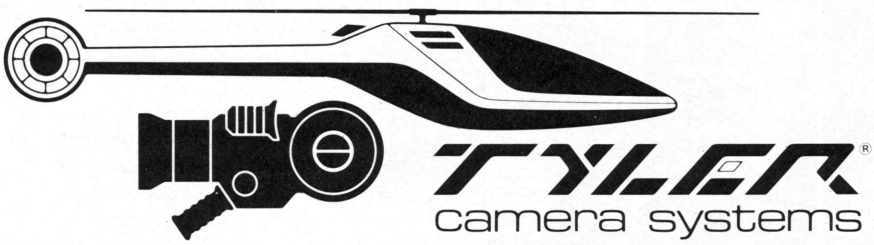

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THE PRODUCER TALKS ABOUT "THE BLACK HOLE"
Continued from Page 41

of its long and successful history of dealing with fantasy subjects, the Disney organization had an advantage in taking on a project as "far-out" as THE BLACK HOLE?

MILLER: Yes. Just from a pure production standpoint, we have at Disney Studios one of the few self-contained facilities that are capable of producing this kind of thing. Everything necessary is available on the lot. We have our own lab with three-headed optical printers and other sophisticated equipment and, of course, a group of superb technicians which includes Peter Ellenshaw, Eustace Lycett and Art Cruickshank—all Academy Award winners.

QUESTION: What can you tell me about the new equipment that was designed and built especially for this project?

MILLER: We couldn't have made this picture without the ACES computerized camera equipment which we developed. The final device is the result of many ideas from many people, but the people who design for Disneyland and Disney World have had a lot of experience in working with a synthesis of computers and mechanical things. They did the design work for ACES, under the direction of the Camera Department. They set up what they wanted the equipment to do and then went out and built it. In actual operation it was sort of spooky how the computer took on its own personality. We would feed the program into the computer and it would come back and say, "Okay, I'm going to do it just like you programmed it." But then he wouldn't; he would do something else. He was lying to us.

QUESTION: How does THE BLACK HOLE stack up technically with other special effects features that Disney has done in the past?

MILLER: We haven't done anything like this in a long, long time. I don't know exactly when the last time was that we did anything so complicated in the area of special effects. I think it almost goes back to the MARY POPPINS days, or beyond that, to 20,000 LEAGUES UNDER THE SEA. Nothing in between those and THE BLACK HOLE has presented such a challenge to our special effects people. ■

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"BLACK HOLE" PHOTOGRAPHY
Continued from Page 36

try to stay away from forcing. Forcing usually creates a veil that is hard to print out. I did force a few shots that had nothing to do with mattes or any optical work, but most of it was straight on, without forcing. Actually, I don't often find it necessary with the Eastman 5247 color negative. I think it's probably the most fantastic film stock ever to come along. It's very realistic in its rendition and very fast. I shoot interiors at f/4 with 70 foot-candles and get a nice full negative. Some cameramen feel that it's too crisp, too realistic, and they use all sorts of methods to soften the look. Occasionally, on a particular film that calls for that effect, I like the soft look myself, but in this one we had a lot of matte paintings and I tried to stop down at least to f/4 so that I could maintain a little more clarity. If you lose definition you come up with a mushy-looking matte.

QUESTION: Very often, in a picture as full of special effects as THE BLACK HOLE, the tendency is for the effects to overwhelm the characters. Did you have that problem in this case?

PHILLIPS: We have a pretty girl (Yvette Mimieux) and good-looking actors in the picture and I tried to keep them looking as nice as possible, while still maintaining our strong effects. Back in the old days at MGM, Louis B. Mayer used to say, "We have stars that we have invested a lot of money in. I want these people to look as glamourous and pretty as they are . . . prettier than they are." I grew up professionally in that era and some of that rubbed off on me. So I like to make people look nice. Most young filmmakers call it "slick old Hollywood movie-making."

QUESTION: Did you use any special kind of filtration on this picture?

PHILLIPS: There again, I used filtration very, very lightly. I used low contrast filters once in a while, but because of the mattes, it's best not to use them, unless the mattes take on a softness themselves. We just stayed away from them. I think that sometimes, in making matte shots, if you use too much filtration, or if your aperture is open so far that you are not carrying much depth of field, you are really defeating yourself. You want to maintain as much clarity and sharpness as you can, so that your mattes won't go mushy. So I tried to stop down a bit. That's why I didn't force-develop or use heavy filters or shoot with ultra-fast

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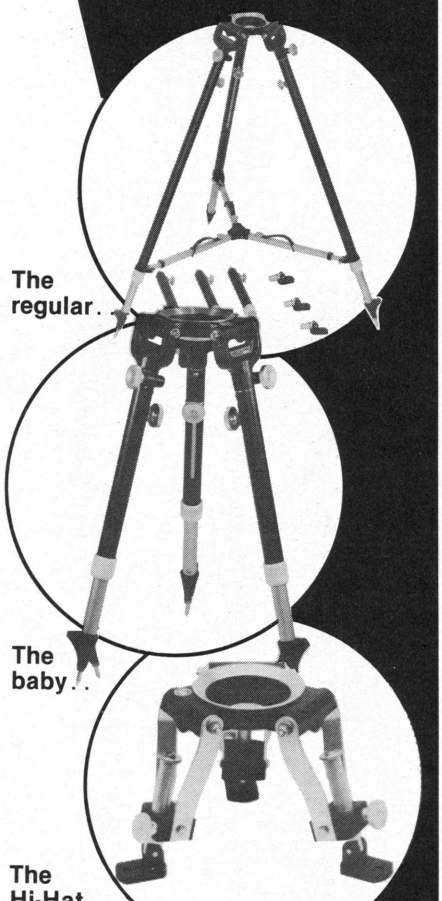

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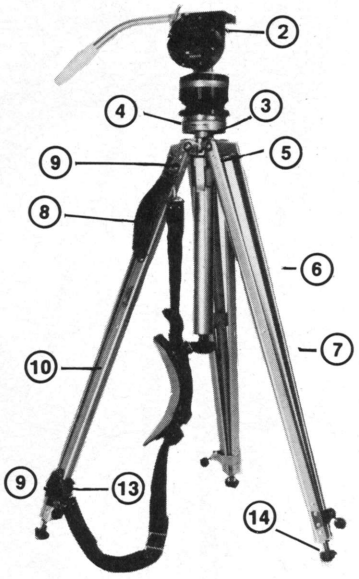

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lenses. I wanted to maintain a little more depth of field.

QUESTION: You spoke of a lot of flashes in certain scenes—from explosions and such. How did that affect your photography?

PHILLIPS: Special effects came up with some very high-potency squibs that used real flash powder. We used a lot of those and they were really hot. They'll burn a hole in the film. However, they were most effective for the kinds of things we were doing. We'd have strings of those things going off, so that there would be a great flash from them, as well as their being seen physically on the screen. If they seemed to overwhelm the lighting at times, that was natural to the situation.

QUESTION: Did you use colored light extensively on this film?

PHILLIPS: Yes, we did use lots of color. I used MT2 gels exclusively on the dining room set in order, hopefully, to give it the warmth and charm of an old English dining room. I used quite a bit of blue light in one sequence where I filled the whole set with smoke, instead of using a fog filter. I used a good deal of orangish red in the scenes where the meteors come crashing through and fiery red at the end of the picture where the ship is sucked into the Black Hole.

QUESTION: Because of its peculiar wave length, doesn't red light give you a softness problem in focus?

PHILLIPS: It gives you a very ghosty look and a very soft look. I usually mix a bit of white light in with the red, but in this case, it was intermittent red flashing, so I got away with it. But you are absolutely right—red usually leaves a very ghosty, hard-to-look-at image on the screen. I can remember a scene on the bridge in THE CAINE MUTINY where they used red to a point where it hurt your eyes. Since then I've tried to avoid red light.

QUESTION: Was there much camera movement in shooting THE BLACK HOLE?

PHILLIPS: We moved the camera extensively, as much as we could. However, since we were using the anamorphic wide-screen format, it wasn't necessary to dolly promiscuously. We used zoom lenses quite extensively where we couldn't get the dolly in or get the dolly to work. The anamorphic format lent added scope to this sort of subject. However, we did run into some problems when

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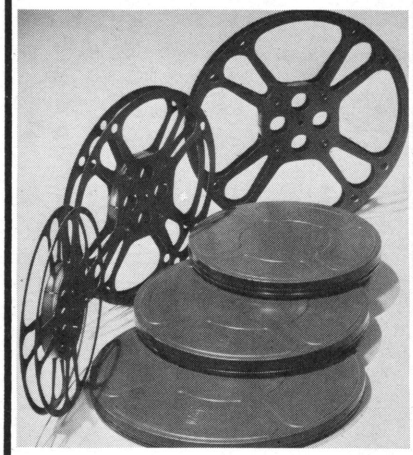

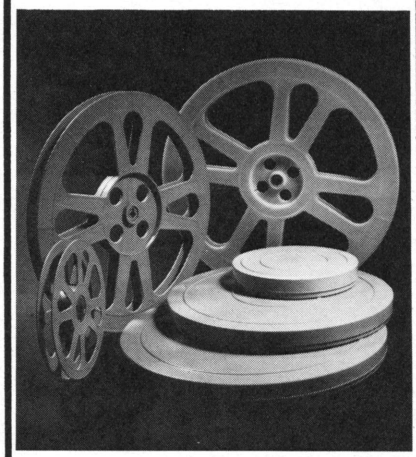

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enlarging it to make the 70mm prints. Our calculations were slightly off and we did end up about 6% short on the sides. On most shots it's not disastrous, but next time we'll know better.

QUESTION: What sort of equipment did you use for photographing THE BLACK HOLE?

PHILLIPS: We used TECHNOVISION lenses, provided by a European company, and the quality of those lenses was excellent. We did have a little trouble early on with one of the lenses that had come from APOCALYPSE NOW, which was filming in the Philippines. We noticed in the dailies that one side of the lens was a bit soft and we sent it back to the company. They found out that fungus had developed between the elements of the lens while it was in the Philippines, but that's the only trouble we had. It was comical, but it could have been disastrous. Fortunately we didn't have to reshoot anything.

QUESTION: What kind of camera equipment did you use?

PHILLIPS: We had some of our Mark II Mitchells converted for use with the TECHNOVISION lenses, but we found that the Arriflex 35BL was the handiest camera we had, mainly because I could squeeze it into close quarters. We had the TECHNOVISION lenses mounted on the Arri 35BL and shot a good deal of the picture with that combination. We also used a BNCR that we had converted. But I found the quality of the Arri 35BL so good that I kept using it and I would say that 70 percent of the picture was shot with it. That camera may look like a toy, but it isn't; it's a fine camera.

QUESTION: Having spent more than half a year in photographing THE BLACK HOLE, what are your observations about the experience at this point?

PHILLIPS: Back in the days when I was a camera operator, I worked on some films that shot for five months. This one went longer than that, but the director, Gary Nelson, worked two years on it and stayed with the entire project from beginning to end, even through the last effects and the music and all the final tuning on the picture. He's had to have more patience than I have. But THE BLACK HOLE represents a gigantic effort on the part of a lot of people, especially the special effects people. They had a tremendous task. But I feel that this is going to be a very, very effective picture. ■

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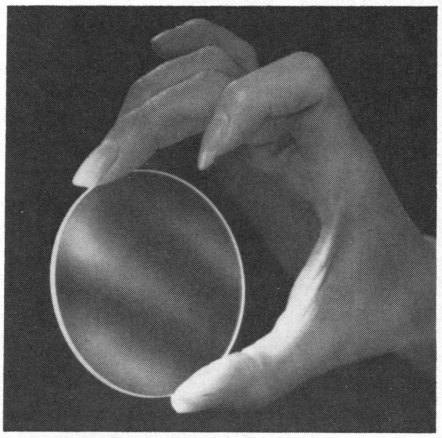

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A DEEP SPACE WORLD FOR "THE BLACK HOLE"
Continued from Page 77

are now thinking that they can take up compressed sections and, when they get out in space, blow them up as large as they like. Other modules can be squeezed so that they will open up rather like those kind of scissors things that you reach out with by squeezing.

QUESTION: To what extent did you research the technical feasibility of the spaceship, or could you just let your imagination run sort of loose in that respect?

ELLENSHAW: I let my imagination run loose, knowing that we could make the spaceship as large as we wanted it to be. I just designed something that would be an interesting shape, something a little different from what everyone else had designed. Without trying to be too far out, I didn't want it to look as though we were copying what other people thought should be done.

QUESTION: You have built a vast reputation on the basis of your outstanding matte paintings. Did you actually execute any of the mattes for THE BLACK HOLE?

ELLENSHAW: The mattes were entirely the responsibility of Harrison Ellenshaw, who happens to be my son. He's in charge of the department and I had nothing to do with the mattes—nothing at all. I don't even give an opinion of what I think of a matte until it is finished—which is the way it should be. After all, I painted mattes for many years, but if I was in there telling him what to do it would be very frustrating for him—and for me. I feel that he is creating an exciting, interesting concept, and I leave it to him to come up with the result.

QUESTION: What kind of rapport did you have in working with the Director of Photography?

ELLENSHAW: I had a great rapport with Frank Phillips, because we've worked together many times. He's not a man who considers that he's God. He's very cooperative. We discussed the visual concept very thoroughly with the producer, who wanted it to have the same feeling as the paintings that were done. We discussed it with Frank and he came up with the same effect that we were trying to get in the paintings. Frank has cooperated completely and been most helpful in every way. The effect is quite different from what we have been used to doing at Disney. We usually have a kind of cotton

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candy effect, rather than the mysterioso effect we have in THE BLACK HOLE.

QUESTION: Did you personally do any of the storyboarding for the film?

ELLENSHAW: I didn't storyboard the picture at all. I just did sketches showing the various major sets and the components. The direct influence of these sketches on the storyboards was only minor. Mostly the storyboards were under the direction of Gary Nelson. My sketches served only to point up the way the sets should look.

QUESTION: What about the interplay of your basic designs with the special effects that are so vital to a subject like this?

ELLENSHAW: My first experience in the film business was working with special effects. Therefore, I take to that aspect of filmmaking quite naturally. As a matte artist for so many years, I was used to having effects interlock with design. When I came to work with Walt Disney my work took on much wider dimensions, because Walt would always give me additional challenges, rather than simply leaving me in the background as a matte artist. He would insist that you open up your life and try other things. I worked on production design for JOHNNY TREMAIN, back in 1957 and before that I did the design sketches for the mattes we were going to use in 20,000 LEAGUES UNDER THE SEA. That's when I first got to working on production design, as well as mattes. I had to incorporate special effects into my mattes, so that the two would work well together. When I first came to America from England, Walt insisted that I work closely with the effects people, so that my paintings would tie in with what they were doing. Gradually it worked out so that I was always concerned with the effects and the two interlocked very well.

QUESTION: You mentioned earlier that you wanted your design to be different without going too far out. Just how innovative did you get in terms of the actual projected state-of-the-art for space travel?

ELLENSHAW: Contrary to the way it was reported—namely, that I felt I would be able to show NASA how the future would be—I wouldn't be so pretentious as to imply that I know as much as any of the space people. All we are trying to do is make an interesting movie, rather than be too smart about it. I think that the future in space is exciting and it was, for me, a very exciting experience to be involved in the making of a space picture. ■

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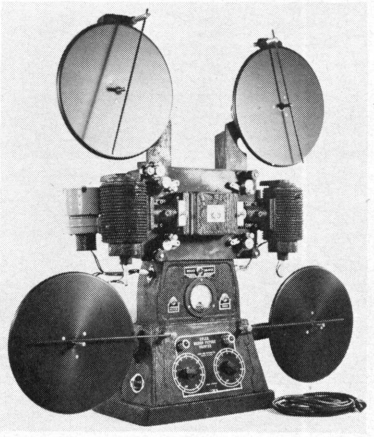

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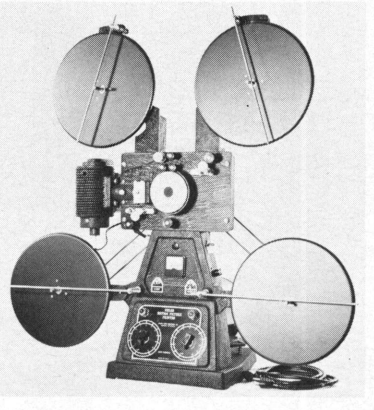

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PHOTOGRAPHING MINIATURES ON A MASSIVE SCALE

Continued from Page 74

Most of the explosions that were not photographed directly were shot with a camera rented from Bruce Hill that films at 15 times normal speed, and we added these optically to the Cygnus when it goes through its final demise. We didn't shoot the miniatures themselves at 15 times normal speed, obviously, but only the explosions and these were composited with miniature footage that I had previously shot either with the ACES equipment (which I used on a stop-motion basis) or when I was using a high-speed Mark II Mitchell cranking at a maximum speed of 128 frames a second—a little more than five times normal.

The camera that we rented from Hill was a 35mm Photosonics Model 40, which has a filming speed range from 6 to 360 frames per second. It is pin-registered, operates on 220 AC single-phase current and accepts either BNC or Panavision-mount lenses. It is bore-sighted, but also has a side reflex finder for a 24mm-240mm zoom lens. It has a digital readout capability, a 1000-foot magazine and weighs 160 lbs.

We created the Black Hole itself with a vortex in a six-foot circular tank that was six feet deep. We dropped red and black paint in it and photographed it with the Photosonics camera at 15 times normal speed. In order to get the proper type of vortex, we had to rotate the water in the tank at an extremely high rate of speed, but in contrast, we wanted the Black Hole to appear to be turning very slowly, so the answer was the 15 times normal frame rate. I did make some tests with a model of Photosonics camera that runs at 2,500 frames per second, but it has a rotating prism and no pin-registration. The frame fluctuated so badly that we had to reject it, although I sure hated to do so because it does some pretty spectacular things.

Even 15 times normal was not sufficient to give us the slow-rotating effect we wanted, so we took what we had shot at that rate and double-framed it in the optical printer. I wasn't too happy with the idea of double-framing, but at that fast speed, double-framing does not produce a jitter. It worked out fine and the Black Hole that appears on the screen is actually moving 30 times slower than normal, although I would have been happier if we had actually been able to film it at 30 times normal speed.

We had to pour a lot of light onto the vortex because of the 15 times normal speed, but most of the scenes shot at that speed were self-illuminated, since explosions are their own light source. However, we did have an illumination

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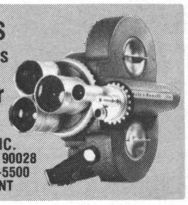

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problem even at five times normal on some of the other miniature shots, many times having to use 8,000 footcandles on the models.

Filming the miniature robots didn't present any special problems, because they were all photographed in long shots and weren't fully functional. The only problem we did run up against was in the sequence where the robot called Vincent goes outside of the Palamino spaceship while it is tumbling in space and he has to lock up a door that has blown open. We spent a considerable amount of time trying to maneuver Vincent into a position while he was in contact with the Palamino, so that he would stop at the right place and be able to extend his arm and hook it up to the door handle. That took a lot of time but, here again, the mechanical effects people, by means of diligence and hard work, were able to do it.

During the battle between the, let's call them "good guys" (the Palamino robots), and the "villains" (the robots on the Cygnus), they go through various maneuvers like loop-the-loops and barrel rolls. These were shot in front of the blue screen with miniature robots on mechanical devices that would allow them to loop, but the device was so simple that we didn't run into any problems. Here again, the mechanical effects people made it all happen.

For the sequence in which the Cygnus breaks up and is drawn into the Black Hole, the spaceship miniature was shot separately from the vortex, to be composited later. I shot the miniature in front of the blue screen and, since in this case I was shooting at 128 frames per second, I had to light the blue screen with arcs.

We have at Walt Disney Studios three blue screen configurations. The first is a Stewart Blue screen that is back-lit with 5500° Kelvin fluorescent tubes. That's the most efficient blue screen I've ever worked with. Then, on Stage 4, we have a 60-foot-wide screen that is back-lit with 3200° Kelvin light. Neither of those screens would allow you to crank at a high rate of speed, because the light output is not sufficient. So we also have a blue velour cloth screen that we can front light with arcs. I lit it with white carbons, which meant that I was, in essence, lighting the blue screen with blue light. To shoot the high-speed scenes we needed, we had to force the illumination up to 8,000 or 9,000 footcandles. We had every arc at Disney Studios lighting that blue screen.

Aside from the problem of getting enough light for high-speed photography, I prefer the 5500°K back-lit blue screen because it cuts so sharply that the blue density runs in the area of 2.0, while the red density reads less, when you read

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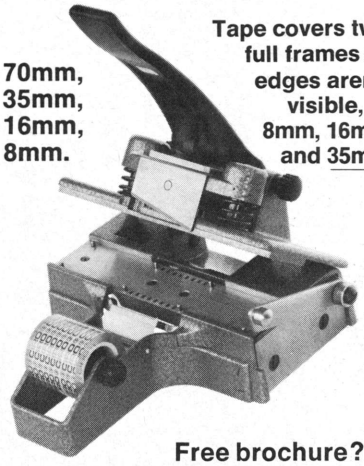

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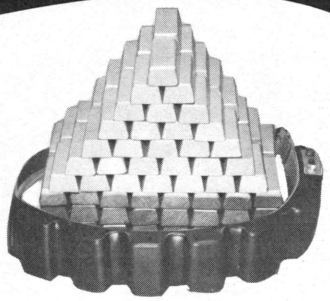

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through a red filter, than the base density of Eastman Color Negative. As you go to corrected (3200°K) light, the red begins to pick up out of the blue screen. Therefore, the separation between the blue density and the red density lessens, and it lessens even more when you use the velour blue, which is less efficient than the back-lit Stewart Blue with the 3200°K lights.

One shot in the picture that turned out to be a great relief to me (because it went much more smoothly than expected) was the scene in which the meteor roars down the inside of the main corridor of the Cygnus, wiping out the grids that our heroes have just left. It required a considerable amount of meticulous planning to make all the pieces of film fit, but that shot was delivered as a first take. We shot the miniature of the meteor rolling down the interior of the Cygnus. Then the people were shot against the side of Stage 4 in full sunlight. The two robots were shot on a cartoon crane and the matte that they run behind was also shot on a cartoon crane. All of the pieces were composited and made to fit a line-up guide that we had put into each camera that was used to photograph a particular element. Everything fit together smoothly, thanks to the dedicated efforts of Optical Photography Coordinator Bob Broughton and his crew.

Our star backing had thousands of holes punched in it, and in order to get the "stars" to shine brightly enough we used 1,250,000 watts of light behind the backing. This created so much heat that we had to have a fireman on the set to temperature monitor the top of the stage. The fireman would tell us when it was alright to shoot and he would cut us off after about 120 seconds. This meant that for any miniature shot against that bright star backing, the shooting had to be completed within two minutes. Otherwise we were in danger of setting off the sprinkler system on the stage, because the temperature got as high as 140 degrees up in the rafters.

We did have a cooling system on the set, but we couldn't use it when we were shooting because it involved the circulation of the air. Our star backing was muslin mounted and if we had air circulating it would cause the backing to weave—which was the last thing in the world that we wanted. So we could turn on the air conditioning system only after we had turned off the lights.

We had originally intended to shoot a lot of our effects in VistaVision for conversion to the anamorphic format, but then we found the Pitching Lens and that changed our thinking. We found that we were able to shoot directly in the anamorphic format for many of the effects. How-

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ever, in the case of the matte camera that Harrison Ellenshaw was using, it was to his advantage to have a VistaVision negative to use on his miniature rear projection systems, so he used a tremendous amount of VistaVision photography, whereas we used it for only a few shots in our miniature photography.

On a picture as complex as THE BLACK HOLE, my main job is to try to get what the director wants, or what the production designer wants, or what the producer wants—to try to give them exactly what they see in their mind's eye, if that's at all possible. It's also my job to tell them when I feel a certain effect isn't feasible, so that we can approach it in some other manner.

There are a lot of times when you have to sit down and have a conversation with the other individuals involved, because you may be misinterpreting their words. That's the reason for storyboards. If you have a picture to look at, that keeps everybody in the same ballpark and cuts down on misunderstandings.

Even so, there is always a certain amount of apprehension with effects photography. All you can do is base what you're doing on what you've done in the past that worked, but there are so many little things that can go wrong. There is apprehension every time you go to dailies, and you find yourself praying that everything went well. If you come out shaking your head, then you go back and do it over again.

First takes on an effects picture are the exception It's a little bit different in cartoon photography, because you're going by a set of instructions that have been tested before you ever arrived on the scene. Live effects for a picture like THE BLACK HOLE are something else again, because first off you sit down and start scratching your head, having been presented with a story sketch, or having had a conversation with Peter Ellenshaw about what it is he wants. Now you've got the machine and you're telling it what you hope will represent a satisfactory end result for the director, the production designer and the producer. Each separate scene is an individual project and your main objective is to satisfy the particular requirements of that scene regardless of how many pieces of film are involved to make the scene look right. That in itself is enough for you to maintain your objectivity. If you don't, you're never going to get the pieces of film fitted together.

The ACES system, which was designed to film certain effects for THE BLACK HOLE, is a very advanced piece of equipment, but I feel that, without a doubt, we're on the threshold of an even more amazing breakthrough with electronic composite photography, whereby

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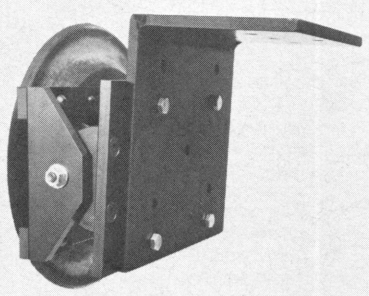

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There are many companies now whose efforts could contribute to the manufacture of a system like the one I've described. For example, some of the bigger national magazines are put together in New York or Chicago and then the technical data necessary for printing localized editions is sent out electronically so that those magazines can be printed simultaneously at various locations. Perhaps an adaptation of that technology is in the future of filmmaking.

Before starting to shoot THE BLACK HOLE we examined such possibilities, but the state of that art was not far enough along that we could conscientiously persuade ourselves that we could complete a picture using such methods.

The filming of THE BLACK HOLE was truly a team effort and several people on the team have worked together for many years. Peter Ellenshaw began working with Disney in the early 1950s. Eustace Lycett has been with the Disney Studios for 42 years and his retirement on December 28th will be a great loss to the studio. I worked at Disney Studios for 24 years and then went to 20th Century-Fox for seven years. Now I'm in my eighth year at Disney the second time around.

After all that time, I am still as enthusiastic as ever about my work. I like to come to work in the morning. I have always loved this type of work. My love for the job keeps me on my toes. When I come to work in the morning, there is always a new set of problems. I enjoy the problems—even though the look on my face may seem to indicate otherwise. ■

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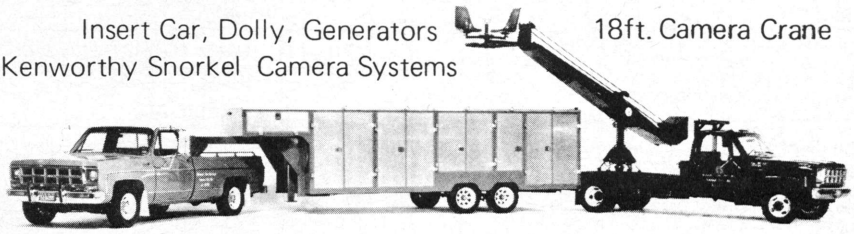

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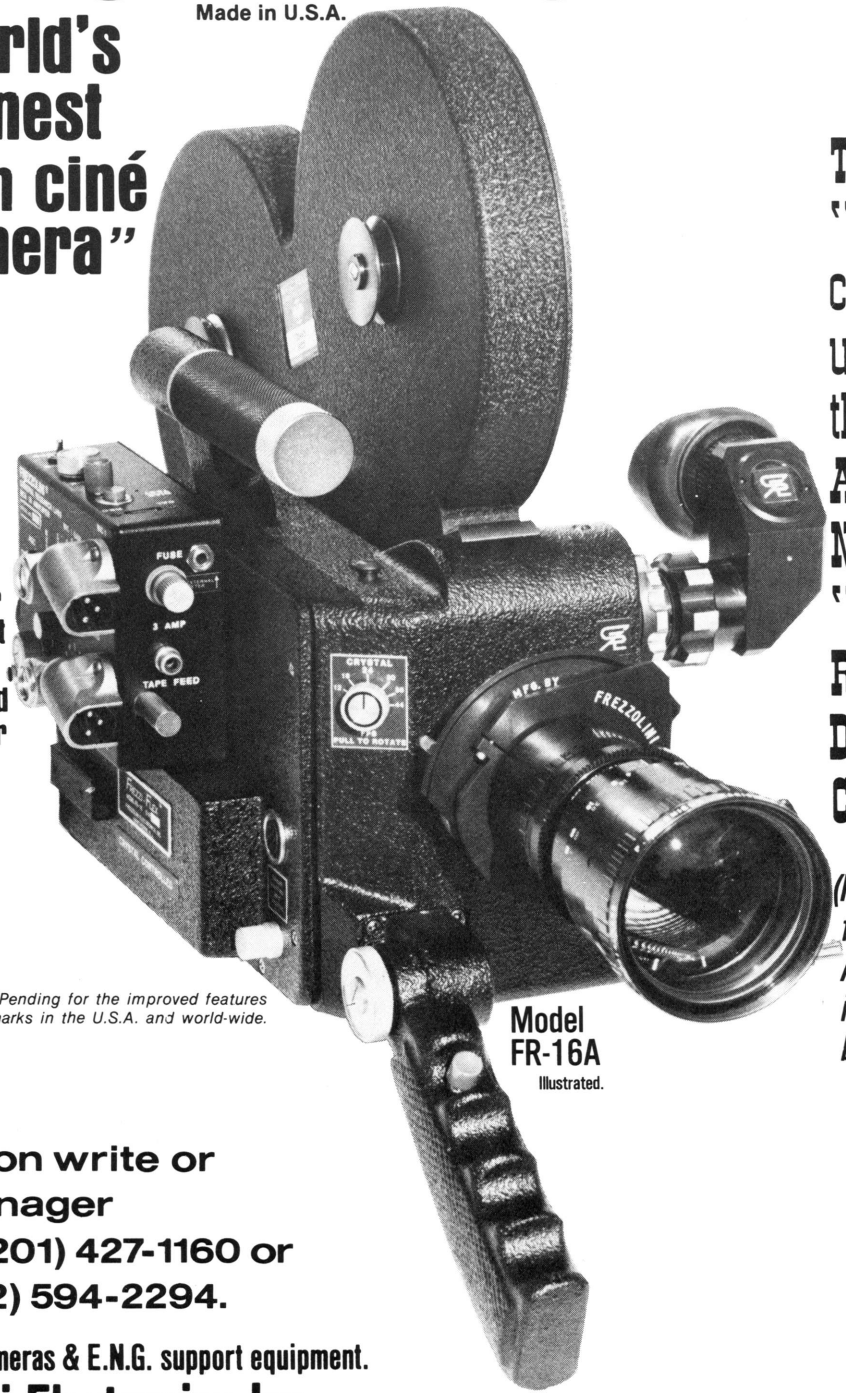

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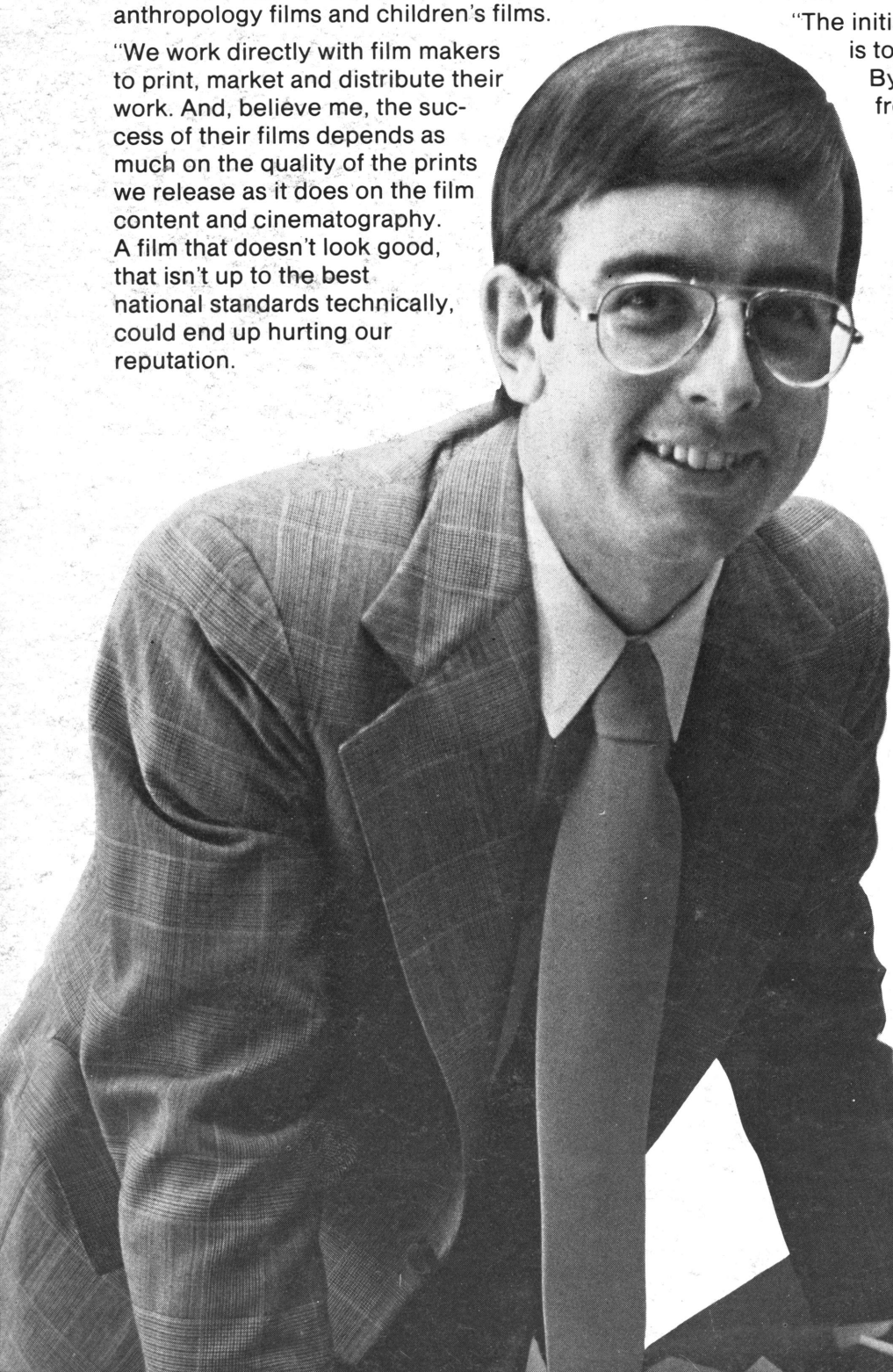

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